THE AEROPLANE

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Aeronautical Engineering
Edited by - - THURSTAN JAMES

Founder and First Editor
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THIS R.A.F. BIRTHDAY ISSUE

PARADOX is out of fashion or we might have been tempted to begin this editorial with some observation having to do with the strange fact that our chief difficulty in producing an R.A.F. anniversary number was deciding what to leave out. At the expense of severely curtailing the regular features we have been able to devote 42 pages of this issue to a survey of the first 40 years of the youngest of the three Fighting Services.

We might have devoted those pages to a year-by-year survey. We might have concentrated on the names of those who, famous in their prime, built up the strength and tradition of that Service to which so much is owed by the many millions of the Commonwealth today. Names may, and indeed do, make news, but our design was not to make news but to look back to these first beginnings of the Service which came into being on April 1, 1918.

At that time the first of the great German wars was raging and indeed the end had yet to be obtained. On the day the R.A.F. was formed British air casualties were comparatively heavy, for the German March offensive had not been stopped. "The War in the Air" reports that 10 aeroplanes were missing, 38 wrecked and four destroyed as the result of a German bombing raid. Of the 38 wrecked, 26 were wrecked through forced descents, the result of engine failure or through faulty landings.

For the first three and a half years of that war, the fighting in the air had been done by the Royal Flying Corps and the Royal Naval Air Service. And it is only right to recall here that it was the vision of the founders of the Naval Air Arm that brought the aircraft industry, as we know it, into being.

We have felt that our survey should include an historical account of the Service from its beginnings and in particular a survey of its activities in the Second World War. Within the unavoidable limitations in which we had perforce to work, a miracle of compressed writing was necessary and we count ourselves fortunate to have had Air Marshal Sir Robert Saundby as author. To bring the position up to date since the end of hostilities in Europe and the Far East we have completed our survey by briefly reporting on the organization, functions and equipment of the Commands of the R.A.F., and of our Air Forces in Europe, in the Middle East and the Far East. To get the information for the latter section members of the editorial staff have flown out to the Far East and, not for the first time, have participated in the operations of the R.A.F., as, for example, flying over the Malayan jungle by helicopter and aeroplane.

Readers will understand that it has proved quite impossible to deal, as we should have liked to deal, in detail with the equipment of the R.A.F., at its beginnings, during the Second World War and since. We thought it best in such circumstances to tabulate the equipment as extensively as possible. We selected a typical fighter and bomber of the opening era and again of the present period; these have been drawn in meticulous detail.

Today we are at the introduction of the S.A.G.W. or surface-to-air guided weapon. Many years ago there used to be much talk of aerial torpedoes. But unlike the "tin fish" of the Navy those torpedoes were versions of bombs. The S.A.G.W. of today is much more like the homing torpedo in that it carries its own propulsion unit with it as well as mechanism whereby it is enabled to home on the enemy aircraft.

There has been talk of manned aircraft being rendered obsolete by the coming of the guided weapon. We are proud of the fact that this issue carries an article specially written by the Chief of the Air Staff, Marshal of the Royal Air Force Sir Dermot Boyle, dealing with this very matter.

He makes clear his belief that the unmanned missile is not bringing the end of the story. He looks to the appearance of a new type of manned vehicle, it can hardly be called an aircraft, perhaps spacecraft would be nearer the mark, in which will be reconciled the concepts of the supersonic bomber and the manned satellite. He believes that the coming of such craft will mark the first steps to the controlled conquest of space immediately surrounding the globe. He believes, too, that this country cannot stand aside from all part in their development.

In this connection it is worth noting that Air Chief Marshal Sir Claude Pelly, Controller of Aircraft at the Ministry of Supply, spoke at Boscombe last week of the slight hysteria which had accompanied the publication of last year's White Paper on Defence. Since then, Sir Claude said, a more sensible and thoughtful approach to manned aircraft had become apparent.

We have thus excellent authority for the view that on its fortieth birthday, under a sky in which man-made satellites are now circling, the Royal Air Force has lost none of the vigour, forward-looking spirit and sense of adventure which in the past have brought the Service to its pre-eminent position. It is not untimely to recall that its crest bears the injunction to press on through difficulties to the STARS.

MATTERS OF MOMENT

Backwards-facing Seats

CONGRATULATIONS to Mr. Gresham Cooke, C.B.E. (Cons., Twickenham), for bringing forward in the House of Commons on March 19 the all-important matter of backwards-facing seats. In the course of his exchanges with the Minister of Transport and Civil Aviation the question was raised, though not answered, of how many of the 22 survivors of the Munich crash were in backwards-facing seats. Mr. Watkinson said the British aircraft could be fitted with seats facing in either direction but it was up to the operators of aircraft to make their own choice.

It will be recalled that writing in THE AEROPLANE for February 28 Air Cdre. Sir Vernon Brown, a former chief inspector of accidents, stated that by the installation of suitably designed backwards-facing seats mortality figures would, in the case of survivable accidents, be reduced to an almost negligible quantity. He asserted that, in his belief, enough information could be obtained to prove the advantage of aft-facing seats by something of the order of 4 to 1.

In THE AEROPLANE for March 21 an official spokesman for the Air Ministry spoke of R.A.F. medical bodies being in possession of much valuable data concerning this matter. He stated that in consequence there should be little difficulty in obtaining medical evidence.

We were glad to see that Mr. Frank Beswick (Lab., Uxbridge) pressed the Minister over the question of I.A.T.A.'s part in this business. We do not see why passengers in British aeroplanes should have to wait on I.A.T.A. The opinion is fairly widely held by those who have studied the matter that the installation of backwards-facing seats will save lives in air accidents. There is assumed to be some passenger resistance to the use of such seats. Nobody has produced any evidence in support of this objection.

Indeed, our experience of travelling in B.E.A.'s Elizabethans is that backwards-facing seats are certainly not unpopular. And if people are prepared to travel uncomfortably in the new third class seating to save money, surely they will be prepared to travel facing backwards to save their lives in a crash?

Gnat Trainers for the R.A.F.

STARTED as a private venture in 1956, the Folland Gnat Trainer has been ordered for the Royal Air Force. The instructon to proceed with preliminary design work given last August has now been followed by an order for 14 aircraft as a development batch.

The transonic Gnat Trainer design is a logical derivation from the Gnat light fighter, both of which were described in THE AEROPLANE for November 22, 1957, with a cutaway drawing.

Principal differences of the trainer are: The provision of two seats in tandem; an integral construction, larger-area wing (175 sq. ft. compared with 136.6), which is 7% thick instead of 8% (the supersonic Gnat Mk. 2 will have a 6%-thick wing); a de-rated Bristol Orpheus turbojet; outboard ailerons and inboard split flaps in place of inboard, droopable ailerons; larger-area tail surfaces; extra fuel in place of guns and ammunition; front fuselage lengthened by nine inches; a slightly different elevator-locking device is used and the manual reversion system is altered. The overall length is increased from 29 ft. 8 in. to 30 ft. 9 in. and wing span is now 24 ft.

The rear pilot is accommodated where equipment and fuel were located in the fighter, the reduction in tankage capacity being more than made up by the space formerly used for gun bays and by integral tanks in the wing.

As with the Gnat, Mk. 1 Folland lightweight ejector seats developed from one of the Swedish Saab designs are used, the telescopic ejection guns giving a velocity of 80 ft./sec.

Powerplant of the Gnat Trainer is the Bristol Orpheus B.Or.4

President of the Air Council, Her Majesty's Secretary of State for Air, the Hon. George Ward, inspects the cockpit of an English Electric P.1B during a recent visit to Warton. This new fighter aircraft, as explained in the special R.A.F. supplement which begins on page 416, will play a vital part in re-equipping Fighter Command.

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(Howard Levy photograph)

CANADIAN DETERRENT.—Avro Aircraft's Arrow, designed specifically as an all-weather fighter for Canadian defence, is of particular interest as a "contemporary" weapons system. Its first flight might well have taken place by the time this issue is read.

EXTENDING THE PUNCH.—Valiants of the R.A.F. are now equipped for flight-refuelling as a means of extending their range. The V-bomber force using this technique is described in this issue (pages 416-417) by Marshal of the R.A.F. Sir Dermot Boyle, Chief of the Air Staff, as "a flexible and mobile instrument of power which will present a valid deterrent to our enemies for very many years to come."

of 4,230 lb. thrust. This de-rated power gives a lower specific fuel consumption and longer engine life; a larger-diameter turbine is used because of the lower operating temperatures. All marks of the Orpheus were described, with a drawing, in THE AEROPLANE for November 22 last. The Gnat Trainer will be the first R.A.F. aircraft to have the Orpheus.

Refuelling the V-Force

DETAILS of the probe and drogue flight refuelling system for Bomber Command Valiants have now been released. Working in conjunction with Flight Refuelling, Ltd., Vickers-Armstrongs (Aircraft), Ltd., have applied the technique to the Valiant as part of the development programme for the aircraft.

All Valiants in service can be modified to become a receiver or a tanker, and a large number of production aircraft were built with the basic fittings for either rôle. To convert an aircraft to the tanker rôle involves the installation of a bomb-bay fuel tank complete with an air-turbine pump and piping; fitment of air-turbine pumps in the fuselage tank cells; installation in the bomb bay of the hose drum unit, piping and fuel pump; fitment of a bomb-bay fairing, and underwing tanks; and the installation of the fuel transfer control pump. The receiver conversion only involves the fitting of a probe.

At the start of a refuelling operation the tanker Valiant trails the refuelling hose to its full length of some 90 ft. To resist the air loads on the drogue an electric motor is geared to the hose drum via a fluid coupling and tends to wind the hose back on to the drum. The drogue, however, gives a set load for a given airspeed which is in excess of the "wind in" load of the hose unit, and consequently the hose trails to its full length.

The receiver Valiant flies the probe into the drogue at a relative speed of 3 to 4 knots and proceeds to close on the tanker. The surplus hose is then wound back on to the hose drum. When the receiver is in the refuelling position the tanker operates the fuel valve.

After completion of the refuelling operation the receiver Valiant drops back to the limit stop at full hose extension. At this point the load on the three spring-loaded toggle arms, which closed on to the probe on contact, will be increased until the break-away load is reached.

East German Engines

AT THE Leipzig Fair, models have been shown of the Baade BB.152 four-jet civil transport (THE AEROPLANE, March 21) and of an engine. This has a 12-stage axial compressor and a thrust of 6,950 lb. It is given the designation 014 and stated to be of East German rather than Russian origin.

It seems likely that the 014 is derived from the Junkers Jumo 012 turbojet developed in Russia after the War by technicians from Junkers and B.M.W. The 012 and the 022 turboprop version were in the design stage at the end of the War, but all the drawings and calculations were destroyed and a new start had to be made (THE AEROPLANE, June 14, 1957).

The 012 was developed in Russia and gave a sea-level static thrust of 6,615 lb.; the 022 turboprop delivered 5,700 s.h.p. at sea-level and is apparently used in the Antonov An-8 and An-10, and the Ilyushin Il-18 as the NK-4. The 014 has an annular combustion chamber with 12 burners and a two-stage turbine. At cruising power the s.f.c. is 0.85 lb./lb./hr. Air mass flow is 110.25 lb./sec. Diameter is 38.58 in. and length is 161.42 in.

It has been reported that the Baade BB.153 is a turboprop design now in the project stage. If this is so, then it would seem logical that an up-to-date version of the Jumo 022 is the powerplant—a turboprop version of the new 014.

Guided Weapon Problems

MR. J. CLEMOW, M.A., with Vickers-Armstrongs (Aircraft) as head of their Guided Weapons Organisation, read a paper on "Problems in the Development of a Guided Weapon" before the Guided Flight Section of the Royal Aeronautical Society on March 20. He introduced the subject by saying that the object of guided-weapon development was to produce an efficient weapon of war; it was not difficult to produce a missile that would fly in suitable circumstances, but the problem was to produce weapons in time to meet the threat, both in performance and quantity. Weapons must withstand storage and transport and usage by the Services, and must be ready for action after little warning.

He, as head of an organization, liked to have four subordinates reporting directly to him, six would be too many. This was fortunate, as guided-weapon work could be broken down into three technical divisions, the Design Division, Experimental Workshop Division, Test and Trials Division, and the equally important Administrative Division.

While it might appear surprising that there was no "Research Division" in his organization, and no "New Projects" or "Assessment" Division, he believed that the head of, say, the Electronics Branch must not only be in charge of the work in hand, but must also be responsible for any forward-looking work. Men in a separate forward-looking group all too soon got out of touch with reality and came to have both feet off the ground. He preferred to form an assessment team *ad hoc* from members of the branches so that new projects stemmed from experience; and the gain in experience of the members of the team working with other branches and with outside firms was a valuable by-product.

In a functional system such as this where, for example, there was a single unquestioned head of all Electronics which included all the projects, he preferred to control individual projects by Project Officers; these must be remarkable men in breadth of vision and qualities of leadership, and their sole interest must be to see their project through: the Project Officer

must be of the same stature as the Heads of Divisions, and he reported to the Head of the Organization. In the familiar language of control engineers, this was a closed loop system.

A detailed programme must be made out, right from the design study stage, with dates and manpower needed. The dates might turn out to be wrong, but the work to be done should be completely specified.

The firing programme needed particular care. It was not the slightest good firing a missile if its components had not behaved satisfactorily when subjected to environmental tests of one sort or another. This was well known, but the objectives of each trial must be fully worked out. Here he must mention the Law of Pure Cussedness in which he firmly believed. Out of respect for this law he endeavoured mostly to fire pairs of rounds, allegedly identical, under conditions as nearly identical as the weather allowed. It was surprising how different the records from two such successful rounds could look.

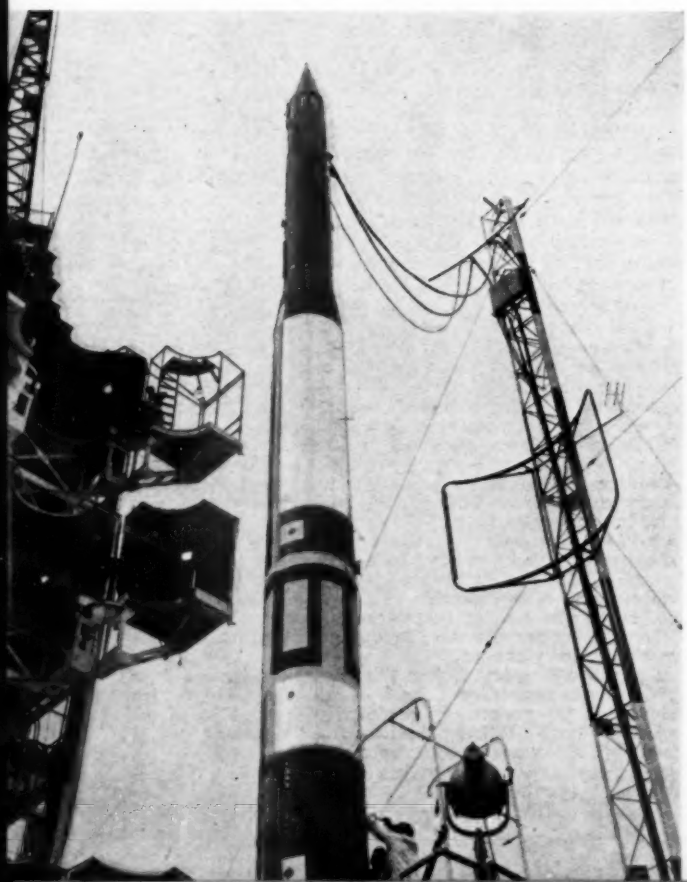
It was necessary to form an opinion, from theoretical work or from simulator runs, of how the results should look. The effects of unexpected conditions should also be known; if perhaps the aerodynamic or control system were to have values higher or lower than supposed, and so forth. This might seem a tedious and extravagant process, but it was much better to have formed a pretty good opinion of these effects before the firing than to try to unravel what had happened afterwards.

He tried to have analysis discussions and conclusions on a firing cleared up in a fortnight otherwise the momentum of trials was lost, and time was all important in weapon development. There was a tendency to make an exact science of it, but there was not the time to analyse fully all the information from a single trial, let alone from a number. But he did not think it too difficult to come to a good decision from the information in the time available. The firing results were compared with forecast results and anomalies could be seen.

After expert study, these were discussed in a round-table meeting at which representatives from all branches were present, and a story had to be produced which would stand up to the criticism of anyone there. The time spent was well worth while; the effort of explaining an occurrence to men of different experience often helped to diagnose a trouble.

Mr. Clemow then brought the fashionable and troublesome effects of cross-couplings down to earth.

The full paper of which this is a summary has much other good information bearing on the development of Guided Weapons.—" KENTIGERN."



America's Second Satellite

ON March 17, the three months of disappointment and frustration suffered by the U.S. Navy team responsible for America's Project Vanguard Earth satellite vehicle, were brought to an end with the successful launching of a Vanguard rocket and the United States' second satellite from Cape Canaveral, Florida. The first attempt to put Vanguard into the atmosphere, it will be recalled, was made on December 6 and ended abruptly in a spectacular failure on the launching pad. Another attempt was made on February 3 but this second Vanguard broke in two after rising to only 20,000 ft. or so. Thus the achievement of March 17 was very much a matter of " third time lucky "—although luck probably had very little to do with it.

The new satellite now circling the Earth is a very small edition of the originally planned 20-in. sphere that Vanguard was to carry. For that reason it is being referred to in the U.S. by its I.G.Y. astronomical designation of 1958 Beta.

Early reports suggest that the sphere—which weighs 3¼ lb. and is 6.4 in. in diameter—is following an elliptical orbit with an apogee of 2,500 miles and perigee of 400 miles. The orbit time has been given as 135 min. It is thus somewhat further out into space than the Explorer satellite (or 1958 Alpha) launched on January 31 which has a maximum and minimum height of orbit of 1,700 and 210 miles respectively, and a " flight time " of 114 min.

It is interesting to note here, the different configuration of these two American satellites now chasing each other round the globe. Vanguard, as we have said, is a 6-in. sphere; it was finally put into orbit by a 50-lb. 5-ft. third-stage rocket from which it has separated, and which is also circling the Earth. Explorer's satellite on the other hand—put into orbit by a U.S. Army Jupiter rocket vehicle—is part of the fourth-stage solid rocket and is about 6 ft. 6 in. long and weighs 31 lb. complete.

During the remainder of the International Geophysical Year, it is planned to launch seven more satellites of the Vanguard type. It has in fact been reported that the first two of these are likely to have a diameter of 20 in., which means presumably that they will be of the original Vanguard type. It was this initial project that was described at length in a special issue of THE AEROPLANE in June, 1957 (later reprinted as a separate booklet*). The weight of these larger satellites, it might be added, has been given as 21½ lb. which is considerably less than that of the first Russian Sputnik which had much the same diameter and weighed no less than 184 lb.

* Available, price 2s. 6d., from Temple Press Limited, Bowling Green Lane, London, E.C.1.

A LOT FOR A LITTLE.—Weighing some 10 tons and measuring 72 ft. overall America's Project Vanguard rocket succeeded last week in putting America's second Earth satellite into orbit. Above the 6-in., 3¼-lb. satellite is placed into position in the nose of the third-stage rocket.

An Aero-Engine Appointment

FROM de Havillands comes news that Mr. Hugh Buckingham has been appointed managing director of The de Havilland Engine Co., Ltd., and an ordinary director of de Havilland Holdings, Ltd. He has been with the de Havilland Enterprise since 1926 when he joined as a premium apprentice for technical engineering training. In 1928 he was commissioned in the Reserve of Air Force Officers and obtained his commercial pilot's licence in 1929.

From 1930 to 1934 Mr. Buckingham was a sales demonstration pilot and test pilot with the company after which he continued as an executive of the sales department, flying a great deal overseas, until 1939. He then went to New Zealand to form a new de Havilland company and until 1943 remained there as a director and its general manager.

The following year he was appointed to the board of the de Havilland Engine company, and became its principal executive in 1956 when he became general manager. He has been a special director of de Havilland Holdings since 1957.

Aircraft Constructors Dine at Boscombe

LIGHTHEARTEDNESS and gaiety, combined with mutual leg-pulling, characterized the aircraft constructors' dinner at the A. and A.E.E., Boscombe Down, on March 22, although a more serious note was struck in the speeches.

Toasting the guests, AIR CDRE. A. E. CLOUSTON, commandant of the A. and A.E.E., referred to the frank and sincere way the industry worked with the R.A.F. to solve any difficulties which arose. He went on to pay tribute to the test pilots and to the scientists, with whom "he had worked too long and seen too many of their boobs." In jesting mood he elaborated on this theme. But seriously, he said, they admired the scientists, who took the same risks as the test pilots.

Replying for the guests, MR. N. E. ROWE, technical director of Blackburn and General Aircraft, Ltd., spoke of his time at Martlesham Heath and the early dinners in the series which he had known. Originally there was a contractors' guest night; today we had a constructors' dinner. Might we not in future have a collaborators' dinner away, he suggested, to be followed by a return corroborators' dinner at the A. and A.E.E.?

On a serious note Mr. Rowe spoke of his faith in the future of aviation, which was a dynamic business. Despite cutbacks and a change in emphasis there was a big future for aviation.

AIR CHIEF MARSHAL SIR CLAUDE PELLY, Controller of Aircraft at the Ministry of Supply, proposed the toast to the aircraft industry. He said that a slight hysteria seemed to have followed the 1957 Defence White Paper. Today there was a much more sensible and thoughtful approach to the future of manned aircraft. He went on to speak of the future role of Boscombe Down, which had before it at least 2½ to 3 years of work on military aircraft. Looking farther ahead, he speculated about the possibility of the A. and A.E.E. playing a part in the development of civil aircraft.

Replying on behalf of the industry, MR. C. F. UWINS, S.B.A.C. president and Bristol Aircraft chairman, made a plea for orders on behalf of the industry. Boscombe Down might have work for 2½ to 3 years, he said, but the aircraft involved had long since passed through the industry's design offices. Unless orders were placed, he said, the industry would be in a critical position and without sufficient design or production work.—J.R.C. (Cartoon page 411).

Farnborough's Third Superintendent

LAST week we briefly recorded the death, at the age of 86, of Lt.-Col. Mervyn O'Gorman, C.B., D.Sc., M.Inst.C.E., M.I.Mech.E., M.I.E.E., F.R.Ae.S. He played a noteworthy part in British aeronautics from 1909 onwards. In the 1920s he was active on many aeronautical committees.

He had first come on to the aeronautical scene in 1909 when he was appointed Superintendent of H.M. Balloon Factory at Farnborough. This post he occupied for seven years—a formative period of great importance to the establishment.

Born at Brighton in 1871 Mervyn O'Gorman was educated at Downside School and University College, Dublin, taking his degrees in both classics and science. Then he studied electrical engineering at the City and Guilds Institute. He joined Fowler Waring Cables. Later he was with Western Electric and the Glover Cable Company.

During his period at Farnborough the Balloon Factory with 100 employees in 1910 changed first into the Army Aircraft Factory—in April, 1912. A year later this became the Royal Aircraft Factory charged with the tasks of "the higher training of mechanics for the R.F.C.; tests with British and foreign engines and aeroplanes; experimental work; the existing work in the manufacture of hydrogen and generally meeting the requirements of the Airship and Kite Squadrons; and general maintenance of the factory and its policy." By 1916, when O'Gorman moved from Farnborough to become consulting engineer to the Director-General of Military Aeronautics, the Factory had increased its personnel fifty-fold.

Notable aircraft produced there between 1912 and 1916 included the B.S.1 of 1912 and the S.E.4 of 1914 which was followed by the F.E.2 series, the F.E.8, the S.E.5s and the R.E.8. In 1913 came the start of a long series of Royal Aircraft Factory aero-engines. And in addition to superintending all these various tasks, O'Gorman served on Col. J. E. B. Seely's technical sub-committee which produced the report leading to the constitution of the Royal Flying Corps.

From 1921 to 1922 he was chairman of the Royal Aeronautical Society. He was also chairman of the Schneider Trophy Races Committees from 1927 to 1929. In 1928 Lt.-Col. O'Gorman became vice-chairman of the Royal Aero Club and later from 1934 to 1943, he served as a vice-president of the Club. Other posts he occupied included that of chairman of the League of Nations Committee on Aero-engines and vice-president of the *Fédération Aéronautique Internationale*.

Gordon Percy Olley

WITH the death, on March 18, of Capt. Gordon P. Olley, M.M., air transport has lost a personal link both with the very early and more adventurous days and with the period when the industry was becoming consolidated. All who knew Croydon Airport in the 1920s and 1930s will remember the quick-moving and compact figure of Gordon Olley, with his fast, clipped way of speaking—and will regret his passing. He was born on May 29, 1893.

It is difficult to realize that this vigorous little man had completed, as a pilot, 12,000 of his final total of more than 13,000 hours by 1931—during, in fact, the first 10 years of the growing air transport business. He flew for Handley Page Transport on the first Continental air services between 1919 and 1924 (at Cricklewood and Hounslow, before Croydon), and also for K.L.M., when this company started operations in 1921. When Imperial Airways was formed in 1924 Olley remained and in 1927 he became head of its Air Charter Department.

I met him for the first time when I flew as super-cargo on a charter flight to the Isle of Man in an A.W. Atalanta. This four-engined monoplane was fairly "hot" for those days and had no flaps. A successful approach into Ronaldsway aerodrome had to be made with great accuracy and I remember that we went round again because we crossed the boundary with the merest trifle of excess speed on the first attempt.

In 1934 Gordon Olley started his own charter company. This, though it was taken over in 1953 by Morton Air Services, still retains a separate identity under its original name of Olley Air Service. He was a director of Isle of Man Air Services and of the Great Western and Southern Air Board (when the railways had taken over most of the domestic air operations in the country) and was a founder-member of the British Air Charter Association, the precursor of the present B.I.A.T.A. Between 1939 and 1946 he was deputy manager and operations manager of the Associated Airways Joint Committee.

Not many people will remember that he and Anthony Fokker flew Fokker biplane gliders in the 1922 competitions at Itford Hill. Gordon Olley won second prize and set up a duration record. More unusual is the fact that he enlisted in the R.F.C. in 1914 and was an air mechanic in France before being accepted for training as a pilot. As an N.C.O. pilot he won the Military Medal before receiving his commission.—H.A.T.

News of Aircraft, Engines and Missiles

NUCLEAR PRINCESSES?—By the time this report appears Capt. E. D. Clarke, managing director of Saunders-Roe, Ltd., will have returned from the United States. He has been discussing the possibility of the U.S. Navy ordering Princess flying-boats for nuclear-power-plant investigations.

QUIET STOPPER.—A combined turbojet thrust-reverser and noise-reducer is being developed by the Rohr Aircraft Corp. Rohr built the Boeing-designed noise-reducers fitted to the Boeing 707 prototype and also build the complete turbojet power-packs for the 707.

VICTOR ORDERS.—It is reported that a second order for an undisclosed number of Handley Page Victors has been placed.

DESFORD AGAIN. — The Reid and Sigrist Desford, formerly used for prone-flying experiments by the R.A.E., has been modified by Air Couriers, Ltd., for Film Aviation Services, Ltd.

CIVIL MAMBA. — Special category approval for the Armstrong Siddeley Mamba A.S.M.8 Mk. 505 turboprop engine has been given by A.R.B. The new civil Mamba has a 2,075 e.h.p. take-off rating at an s.f.c. of 0.665 lb./e.h.p./hr. The cruise s.f.c. is 0.68 at 1,825 e.h.p. Weight is 975 lb., dry.

FOR FATIGUE.—The second Comet 4 off the Hatfield production line is to undergo fatigue testing in the water tank there.

LATEST B-52.—The very long-range Boeing B-52G with integral wing tanks, will have a 40 ft. high fin (48 ft. 3½ in. on earlier B-52s). Tail guns will be remotely controlled from amidships instead of by a gunner in the base of the fin. Engines will be the Pratt and Whitney J57-F-43W and the B-52G will carry the North American GAM-77 Hound Dog stand-off bomb.

FIRST FLIGHT.—The Antonov An-14 Pcholka STOL transport has made its first flight in Russia. The mock-up was shown in our issue for August 9, 1957.

PLASTIC BIRD.—Bull Goose, the Fairchild diversionary missile, is reported to have been fired recently at Cape Canaveral. It is mainly of glass-fibre so that it is a poor target for radar detection and is used to confuse radar stations during attacks by bombers or other missiles.

AVON APPROVAL.—Full normal-category A.R.B. approval has been given to the 10,500-lb. s.t. Rolls-Royce Avon RA.29 Mk. 525 civil turbojet for the Caravelle and Comet 4. The RA.29 has been tested to the requirements of the new combined U.S.-U.K. civil type test and has been flown for over 5,500 hr. in Comet 2Es of B.O.A.C. It has an A.R.B.-authorized overhaul life of 750 hr.

AERIAL DINGHY.—Newly named "Esquif" (small boat) the Air-Fouga CM175M (formerly the Magister Marine) twin-jet trainer has undergone qualification tests for the French Navy. The land-based CM170R Magister is to be built by Bedek Aircraft, Ltd., in Israel.

FIGHTER PROJECT.—It is reported that the Lockheed 357 is a light-fighter project of the same type as the Northrop N-156F "counterair" fighter.

TARTAR CONTRACT. — An $8 million contract has been awarded to Convair for pilot-line production of Tartar guided weapons. The Tartar is a small surface-to-air missile for launching from ships.

Commercial Aviation Affairs

C.A.B. ACCEPT.—Formal approval of the C.A.B. for the economy-class services on the North Atlantic was signified on March 14. Details of the airlines' plans for introducing this class of service are on pages 413 and 414.

SOUTH AFRICAN 707s. — Boeing have confirmed the South African Airways order for three 707-320s, to be used on the London-Johannesburg Springbok service. Delivery is scheduled to begin in July, 1960.

DC-8 SCHEDULE.—The first engine pod for the Douglas DC-8 was delivered to Long Beach by Ryan Aeronautical Co., the sub-contractors, in mid-March, and delivery of the first production set of four engines is expected to be complete by the end of this month. *Aviation Daily* reports that Ryan "has had a picked crew working around the clock and on week-ends to catch up on completion" of the first set. First flight of the DC-8 had been scheduled for late March.

B.O.A.C. TO SOUTH AMERICA.—In a written reply last week in the House of Commons it was stated that B.O.A.C. is likely to resume operations to Brazil, Uruguay, Argentina and Chile in 1959.

DEVELOPED D.H.—This new picture of the D.H.121 short-haul turbojet which B.E.A. propose to buy shows several design changes since the original impression was released (THE AEROPLANE, February 7, p. 166). Changes include lower side engines, with longer nacelles and silencers on all engines; taller fin, larger tailplane, 30 (instead of 32) cabin windows each side and additional roof windows in the cockpit.

IATA CHANGE.—By way of an experiment the 1958 business of the IATA Traffic Conferences will be conducted during two separate shorter sessions in place of the single long session previously used. The first meetings, in the Caribbean area from May 13, will deal with procedural and non-policy matters; the main conference, to be held in the south of France from September 23, will deal exclusively with fares and rates and questions of major policy.

RUSSO-INDIAN AGREEMENT.—An air transport agreement has been signed in Moscow with a view to establishing direct air service between New Delhi and Moscow through Tashkent. The service is expected to be inaugurated in May or June, with Aeroflot using Tu-104s and Air India using Super Constellations.

NEW COACH-AIR SERVICE.—On April 1 Air Charter is starting new coach-air services between London and Calais, Rotterdam and Ostend. The return fare to Calais will be £6 17s. and the elapsed time for the journey will be 2 hr. 25 min. Coaches will take passengers from Euston Square to Southend, whence they will fly in vehicle-ferry Bristol 170s. The services will be daily throughout the year, with from three to five services during the week-ends in the peak holiday season.

AUSTRIAN OPENING.—Daily service between London and Vienna will be inaugurated by Austrian Airlines on March 31. The company will be using Viscounts leased by Fred Olsen and flown by Norwegian crews.

MET. BROADCAST.—On April 1, operational trials will be started of a low frequency radio teletypewriter meteorological broadcast in the North Atlantic region.

K.L.M. STRIKE ENDS.—The strike of K.L.M. pilots ended on March 20 after four days, with both sides apologizing for actions which had created wrong impressions. The president and vice-president of the Dutch Pilots' Association (a member of I.F.A.L.P.A.) who had been dismissed by K.L.M., have been reinstated. All K.L.M. services were back to normal by March 21.

Next Week

Two special features on Russian aviation—"Flying in the Tu-104," an article by a well-known British aeronautical engineer, and "A Bee-line to Moscow," by one of the members of the recent official delegation to Moscow, with exclusive details of Russian A.T.C. procedures.

News About People

R.A.F. CORRIGENDA.—On pages 426 and 436 impermissible contractions have occurred in the titles given to two of the R.A.F.'s senior officers. Reference should have been made to the A.O.C.-in-C. of Technical Training Command as Air Marshal Sir Arthur McDonald, K.C.B., A.F.C., and to the C.-in-C. of the 2nd Tactical Air Force as Air Marshal Sir Humphrey Edwardes Jones, K.C.B., C.B.E., D.F.C., A.F.C.

GIFT TO HENLOW.—Air Cdre. Sir Frank Whittle has offered the R.A.F. Technical College, Henlow, the complete set of his notes and experimental records, which led to his pioneering of the gas turbine aero-engine. Once a member of the College, he visited Henlow last week.

FORTY YEARS of R.A.F. TEST FLYING at A.&A.E.E.—1918-39 Martlesham Heath...1939-58 Boscombe Down
N.E. ROWE (BLACKBURN) WAS CHIEF TECH. OFFICER AT MARTLESHAM.
FRED ROWARTH (LOCKHEED ENGLAND) CHIEF ENGINEER AT MARTLESHAM, TOOK A.&A.E.E. TO BOSCOMBE, WITH
E.T. JONES (M.O.S.) WHO HAD TAKEN OVER C.T.O. FROM N.E. ROWE.
CYRIL UWINS (BRISTOL) WHO FLEW BRISTOL AEROPLANES AT MARTLESHAM AND BOSCOMBE.
AIR CDRE A.E. CLOUSTON (CONT. A.&A.E.E.) EX-TEST PILOT AND PRE-WAR AIR RACING PILOT.
A.C.M. SIR CLAUD PELLY CONTROLLER OF AIRCRAFT (M.O.S.)
BILL LAPPIN (ROLLS-ROYCE) WHO HAS NEVER MISSED AN A.&A.E.E. CONSTRUCTORS' DINNER.

Gp. Capt. J. B. Veal, C.B.E., A.F.C., who has been appointed to the new post of Deputy Director-General of Navigational Services, M.T.C.A. He was previously Director of Civil Aviation Safety and Licensing.

D.O.T. APPOINTMENT.—Mr. J. R. K. Main has been appointed Director of Civil Aviation in the Canadian Department of Transport. He succeeds Maj. R. Dodds, who has retired.

D.H. POST.—Mr. M. G. Ash has been appointed financial director of the de Havilland Engine Co., Ltd. He has been Secretary of the company since 1946 and a director since 1955.

NATO POST.—Gen. Leon Johnson, U.S.A.F., has been appointed Air Deputy to the Supreme Allied Commander, SHAPE.

Military Aviation Affairs

ARMY DESIGNATIONS.—The U.S. Army is apparently using its own designation system for new aircraft; the system is similar to that used by U.S.A.F., with different categories. Examples are HU, utility helicopter (e.g., Bell HU-1 Iroquois); HO, observation helicopter (e.g., Hughes YHO-2, Brantly YHO-3); AO, observation aircraft (e.g., Grumman AO-1 Mohawk) and VZ, vertical (and short) take-off research vehicles (e.g., Hiller VZ-1 Flying Platform and Ryan VZ-3 deflected slipstream prototype).

R.A.F. ANNIVERSARY PROGRAMMES.—The speeches by H.M. the Queen and the Rt. Hon. George Ward at the dinner marking the 40th Anniversary of the Royal Air Force which is being held at H.Q. Fighter Command, on Tuesday, April 1, will be broadcast in the B.B.C. Home Service between 21.55 and 22.20 hrs. On Wednesday, April 2, at 21.15 hrs., the Home Service will present a feature "The First of the Many."

ARGUS EVALUATED.—The R.C.A.F. has completed its official evaluation of the Canadair CL-28 Argus long-range maritime reconnaissance aircraft. Six of these aircraft are now flying and the seventh, the first to enter service, will be delivered to the Maritime Air Command in April.

GERMAN SQUADRONS.—The first two German Naval Air Arm squadrons to be equipped with Sea Hawks and Gannets are to be formed in the U.K. in May. The Gannet squadron will form at R.N.A.S. Eglinton and the Sea Hawk squadron at R.N.A.S. Lossiemouth.

COMET MISHAP.—The cabin of an R.C.A.F. Comet was punctured during flight recently when a dinghy contained in the port wing blew out, causing the panel covering to strike the fuselage. The aircraft, which was approximately 15 miles south-west of Ottawa, descended from its operating altitude of 41,000 ft. and landed without further incident.

SCIMITAR IN SERVICE.—Vickers-Armstrongs Scimitar strike fighters are being delivered for service with the Royal Navy. The first unit to be equipped with Scimitars is X Flight of No. 700 Squadron, which is based at the R.N.A.S., Ford; this unit was formed in August, 1957. Scimitars will be used as day fighters and atomic-strike aircraft as well as for ground attack and photographic-reconnaissance duties.

AIR TRANSPORT

Explaining the Airline Point of View

FOR yesterday's 13th British Commonwealth Lecture Mr. B. S. Shenstone, chief engineer of B.E.A., chose the difficult but necessary task of explaining some of the problems of the airline business. As he put it in his introduction, he was "not talking *to* airline people, but *for* them," and the title he chose for the lecture—"Why Airlines are Hard to Please"—served to explain both the style and subject matter.

He outlined some of the difficulties faced by the World's airlines today—the small profits, the need for fare agreements and the vital importance of a correct choice of future operating equipment, which often has to be made on inadequate data. Whether airlines are State-owned or privately owned they are all, Mr. Shenstone explained, "chosen instruments," since they cannot operate without Government sanction and are subject to route licensing. All airlines are driven by competition and by the demands of the public to improve the standards and speed of operation.

Mr. Shenstone went on to discuss some of an airline's engineering and equipment-selection problems and to explain why these are not as simple as they might appear to the outsider. "In general, the airlines' big difficulty in a rapidly developing industry is to state their requirements categorically five years ahead." An airline "cannot be 100% certain of what it wants, because it is not in a position to know exactly what is achievable; and the manufacturer, who has got to design and build a flying machine first and foremost, cannot be expected to know exactly what an airline ought to want. So, as usual, it is a compromise, and people on each side, at all levels . . . should know at least a little about the others problems and difficulties."

Of obsolescence, Mr. Shenstone said: "The older the aeroplane, the better it is from the mechanical point of view, and an aeroplane when sold for obsolescence reasons has probably reached its peak of mechanical perfection. The fact that this is the case makes it possible for the smaller airlines to operate more cheaply than those airlines whose fate it is to buy brand-new aircraft."

The lecturer concluded with these comments:—

"The public makes life difficult for the airlines, but since they exist for the public and not for their own amusement, the airlines must press forward in an attempt to keep the public more or less happy, but this is harder and harder to do, and the public is likely to become harder to please, which in turn makes the airlines hard to please. When we recognize that air transport is today, after almost 40 years of activity, still in an infantile state of development, one realizes the extraordinarily difficult road ahead. Even now, as we begin to order aircraft cruising at 600 m.p.h., we are seriously considering aircraft to follow them at 800 m.p.h. and some of us are even making big noises about 1,000 m.p.h.

"But, big talk apart, the airlines of the World are going to make extreme demands on the manufacturers of airframes and engines and providers of airport facilities during the next 10 years or more. The demands will be much more stringent because the aircraft will be much more expensive and the airlines cannot afford failures. The aircraft must be right, and right on time. If they are not, the public will either accuse the airlines of incompetence or, even worse, ignore them."

In a foolscap 24-page appendix to the lecture, Mr. Shenstone runs through a large number of aircraft engineering features which make airlines "hard to please." This appendix will be read with interest by all manufacturers' teams of designers, test pilots, aerodynamicists and service engineers—who should find quite a lot of information of real value in it.

Decline and Fall

STATISTICS issued by the U.S. Air Transport Association show that the steadily declining average load factor on the U.S. trunk operators' domestic services fell still further in February. The figure was 56.14%, or 2.84% lower than in February, 1957. Passenger-miles flown during the month were 1,730 million, an increase of only 1.6% over the same month in 1957, whereas capacity offered went up by 6.8%. Bad weather in Florida is partly blamed for February's poor results, but they are also in keeping with the general recession in U.S. business, which has been having a serious effect on the airlines.

Since January, 1957, the monthly average load factor has only once been over 70% (in June at 70.23%) and has only once been better than the figure for the previous year (in July, up by 1.9%). Yearly average load factors considered on a moving annual basis have declined steadily from 63.86% in January, 1957, to 61.13% in February, 1958.

C.P.A.L. Domestic Plan

DETAILS have been given by Mr. G. W. G. McConachie of the trans-continental routes in Canada which Canadian Pacific Airlines wish to operate. Their application will be heard in public in due course by the Air Transport Board and under the terms of the "new deal" for Canadian operators offered by the Government, there seems to be a good chance that most, if not all, of the routes will be awarded to C.P.A.L. Background to the present situation will be found in THE AEROPLANE for March 7 ("By Britannia to Vancouver," pp. 314-317) and March 14 ("Canada's New Airline Policy," p. 350).

The C.P.A.L. plan is to offer daily service on each of five east-west routes, as follows: Vancouver-Winnipeg-Toronto-Montreal; Vancouver - Calgary - Saskatoon - Ottawa - Montreal; Vancouver-Edmonton-Montreal; Edmonton-Regina-Toronto and Winnipeg-Ottawa-Montreal. Of these proposals the Vancouver-Winnipeg-Toronto-Montreal route would directly duplicate the trans-continental service at present operated by T.C.A. (which also stops at Ottawa)—and permission for such competition will be granted by the A.T.B. only if it is considered that the route is sufficiently economic for two operators. The Winnipeg-Ottawa-Montreal service would likewise come close to competing directly with T.C.A.

To operate these schedules, C.P.A.L. could make available 15 DC-6Bs which will be coming off their international services as the Britannias are introduced from June onwards.

FIRST F-27.—Fokker recently rolled-out the first production F-27 Friendship, several weeks ahead of schedule. It is the first of seven ordered by Aer Lingus, who expect to have the type in service by the end of this year. The Friendship already has a C.A.A. Type Certificate.

Economy Over the Atlantic

F. G. SWANBOROUGH *discusses the introduction of economy-class travel on the North Atlantic on April 1, and reviews the airlines' plans for the coming summer.*

AFTER a great deal of heart-searching and not a little disagreement, the airlines constituting the IATA Traffic Conferences finally decided, in Paris last November, to introduce a new cut-rate class of travel on the North Atlantic. This decision* takes effect on Tuesday next, April 1, on which date 14 airlines will introduce the new economy service between Europe and North America. Present indications are that this move may sound the death-knell of tourist-class travel over the North Atlantic, which in six years of availability has given the airlines over 2½ million passengers.

In economy service, the airlines are seeking to reduce Atlantic air travel to its cheapest—and therefore simplest—level, with none of the trappings which have become associated in the past with, more especially, long-distance flying. The tourist-class idea, which since its introduction on the Atlantic on May 1, 1952, has been widely adopted throughout the World, was the first move in this direction and produced the desired results. In reducing still further the degree of service and amount of space in order to offer a 20% reduction in fare, it seems that the airlines may now be going too far.

Until actual experience of economy service can be obtained, it is hard to say just how tolerable—or intolerable—a 12- or 14-hour flight under these conditions will be. But a glance at some of the configurations shown on the next page suggests that it won't be very comfortable flying, for instance, in a 103-seat, all-economy class Super-G Constellation—with only two toilets.

The limitations agreed by the Traffic Conferences for this service are that the seat-pitch should not exceed 34 in., that the seats should have a restricted recline angle and that the only service in the cabin should comprise simple, cold, inexpensive sandwich meals together with coffee, tea, milk or mineral water. No hot food may be served and no alcoholic drinks shall be offered, free or for sale. No "give-aways" are permitted other than sweets at take-off and landing, and the usual toilet accessories.

By comparison with this, tourist-class passengers, with seats pitched at 36 to 38 inches, with hot meals, a bar service (for which they pay)—and "give-aways" to a value of 25 cents a head—are travelling in luxury. It is, then, worth asking why the airlines have agreed to introduce this service and why some are now planning to abandon tourist class altogether.

The operators have been influenced, no doubt, by the success of tourist traffic on the Atlantic, which now accounts for about 70% of the total. A very large proportion of these travellers, obviously, are paying for themselves—and it therefore follows that a reduction in fare should make it possible for still more self-paying passengers to travel. It also follows that most passengers who flew tourist hitherto will fly economy in future—and this is supported by present booking trends, which show 4-5 economy reservations for every tourist reservation, whereas the overall effect of the introduction of economy travel is expected to be a 20% increase in traffic.

On the face of it, therefore, public acceptance already appears to have justified economy-class plans. But the public is buying, at present, an unknown quantity. How many passengers who make an economy-class crossing will wish, we wonder, to repeat the experience, and how many will prefer, if and when a second occasion arises, to save up for a little longer and to travel tourist. Time alone will tell; some airlines certainly have had misgivings about economy service—although none can now afford to ignore it. It may be, on the other hand, that the majority of economy-class passengers will be folk who in any case would only make one trip of this kind in their lifetime; in which case their reactions are perhaps of less consequence.

Economy-class fares are applicable to journeys between the port of entry on the Eastern seaboard of North America and the first port of call in Western Europe. In fact, economy travel will be offered on flights starting and finishing beyond these two boundaries, but on such flights the fares will be a combination of economy rates for the Atlantic crossing and modified tourist rates for the additional sector—although the entire flight will be to economy standards. The basic fare from which all other economy rates are calculated is $252 (one-way) and $453.60 (return) between London and New York. These fares will be approximately 20% lower than the new tourist rate—which is being increased on April 1 by about 8%.

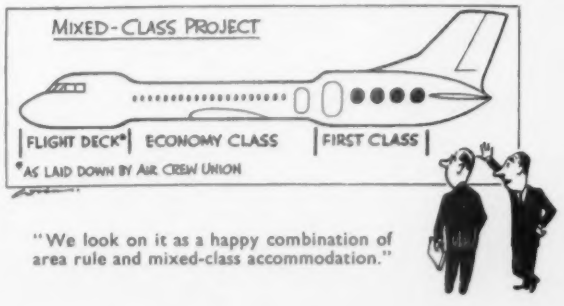
In practice the introduction of economy class has presented difficulties, more especially for operators with small fleets. Right up to the time of writing this article, there has been considerable uncertainty over the best proportions of the various classes, and the best configuration to use. The plans of the various operators, as we understand them, are given in detail later. It will be seen that many airlines are favouring three-class configurations, with a large economy section and small numbers of tourist and first-class or de-luxe passengers.

This arrangement makes it possible to offer maximum frequency in all classes, but complicates bookings and could lead to unfilled seats in one section and loss of traffic in another. Few airlines, however, have a sufficient number of aeroplanes to be able to devote some to all-economy lay-outs, and those that are doing this are still mixing two or three classes on some services. Most airlines are also retaining all-first and de-luxe services at a frequency of one or two a week.

Two airlines will not offer economy service. These are Icelandic Airlines, a non-IATA carrier already offering tourist standard service below IATA rates; and Qantas, who could do so only by maintaining special aircraft for the London—New York sector of their round-the-World service. Because of their small fleets and the difficulty of modifying aircraft without serious loss of revenue, El Al and Iberia both have permission from IATA to offer tourist accommodation at economy fares for a month or two beyond the April 1 deadline.

In addition to the operators already flying on the Atlantic, Irish Airlines propose to start their Dublin—New York service on April 28, and they will then become the only operator offering nothing but economy travel. S.A.S., El Al and K.L.M. have declared their intention of dropping tourist-class completely, while retaining first and de-luxe classes.

Published schedules and plans indicate that, at the height of the summer season this year, at least 18,000 economy seats will be available each week in each direction between the Old World and the New. In all, about 200,000 more seats will be


MIXED-CLASS PROJECT
FLIGHT DECK*
ECONOMY CLASS
FIRST CLASS
*AS LAID DOWN BY AIR CREW UNION
"We look on it as a happy combination of area rule and mixed-class accommodation."

* All IATA decisions are subject to approval by all Governments concerned. At the time of writing, approval of the economy-class plans has not been signified in all cases, but no opposition is expected.

offered in 1958 to allow for the anticipated increase of 20% over the 1,003,000 passengers who crossed the Atlantic in 1957.

In the series of notes which follow, the equipment which the 15 airlines will use is listed, together with the configurations and weekly frequencies. The weekly total of economy-class seats in each case is calculated on a one-way basis.

Air France.—Daily service by L-1049G Super Constellation with 12 tourist and 75 economy seats. Daily service with L-1649 Starliner with four bunks, 16 first-class and 49 economy seats; twice-weekly Starliner service with four bunks, 12 sleeper-seats, 15 tourist and 34 economy seats; once-weekly Starliner service with four bunks, 15 tourist and 60 economy seats. Total, 996 economy seats per week.

Alitalia-L.A.I.—Nine services a week at summer peak by DC-7Cs with 16 first (rear), 6 tourist (forward) and 55 economy seats. Peak total, 495 economy seats per week.

B.O.A.C.—At summer peak, 21 services a week between London and New York by DC-7C with 16 first-class (rear), 17 tourist (main) and 37 economy seats. Five services a week London—Montreal by DC-7C with 16 first-class (rear cabin, with four bunks) *or* 18 tourist (rear) and 63 economy seats (main and forward). Seven flights a week London—Montreal—Detroit—Chicago by Britannia 312 with 12 de luxe *or* 16 first (rear), 15 tourist (main) and 54 economy seats. Two services a week London—New York—San Francisco by Britannia 312 with 12 de luxe (rear), 27 tourist (main) and 45 economy seats. Peak total, 1,560 economy seats per week.

Canadian Pacific.—Two flights a week Vancouver—Amsterdam (originating in Australia) by DC-6B with 12 de luxe (rear), 10 tourist (centre) and 44 economy seats. One flight a week Vancouver—Amsterdam by DC-6B with 12 de luxe and 54 economy seats. One flight a week Montreal—Lisbon—Madrid by DC-6B with 12 de luxe, 10 tourist and 44 economy seats. Weekly offering, 142 economy seats. Commencing in June, Britannia 314s replace the DC-6Bs. Configuration not yet decided: two basic layouts under consideration are 16 de luxe (rear), 48 tourist (front) and 24 economy (centre); or 22 de luxe, 12 tourist and 54 economy seats.

El Al.—Four services a week (increasing to five) by Britannia 313 with 18 first and 72 economy-class seats. Peak total 360 economy seats per week.

Iberia.—Four services a week by L-1049G Super Constellation with 19 first-class (rear), 15 tourist (forward) and 45 economy (centre) seats. Peak total, 180 economy seats per week.

Irish Air Lines.—Commencing April 28, three services a week (increasing to seven) by L-1049H Super Constellation (leased from Seaboard and Western) with 95 economy-class seats. Peak total, 665 economy seats per week.

K.L.M.—Fourteen flights a week by L-1049G Super Constellation with 95-98 economy seats. Six flights a week (to Montreal) by DC-7C with 12 de luxe (rear), 8 first-class and 35 economy (main) and 6 economy (forward) seats. Total, 1,576 economy seats per week.

Lufthansa.—Twelve services a week by L-1049G Super Constellation and L-1649 Starliner. Configuration of Starliner is 6-10 first-class or de luxe (rear), 15 tourist (forward) and 59 economy seats. Peak total, about 700 economy seats per week.

Pan American.—Company plans to split total capacity in proportion of 5% de luxe, 23% first, 9% tourist and 63% economy. Published summer schedules indicate 12 services a week (including seven on Arctic route to West Coast) by DC-7C with first and economy seats; 14 services a week by DC-7C with tourist and economy seats; seven services a week by DC-6B with first and economy seats and 14 services a week by DC-6B with all economy seats. Peak total, about 3,500 economy seats per week.

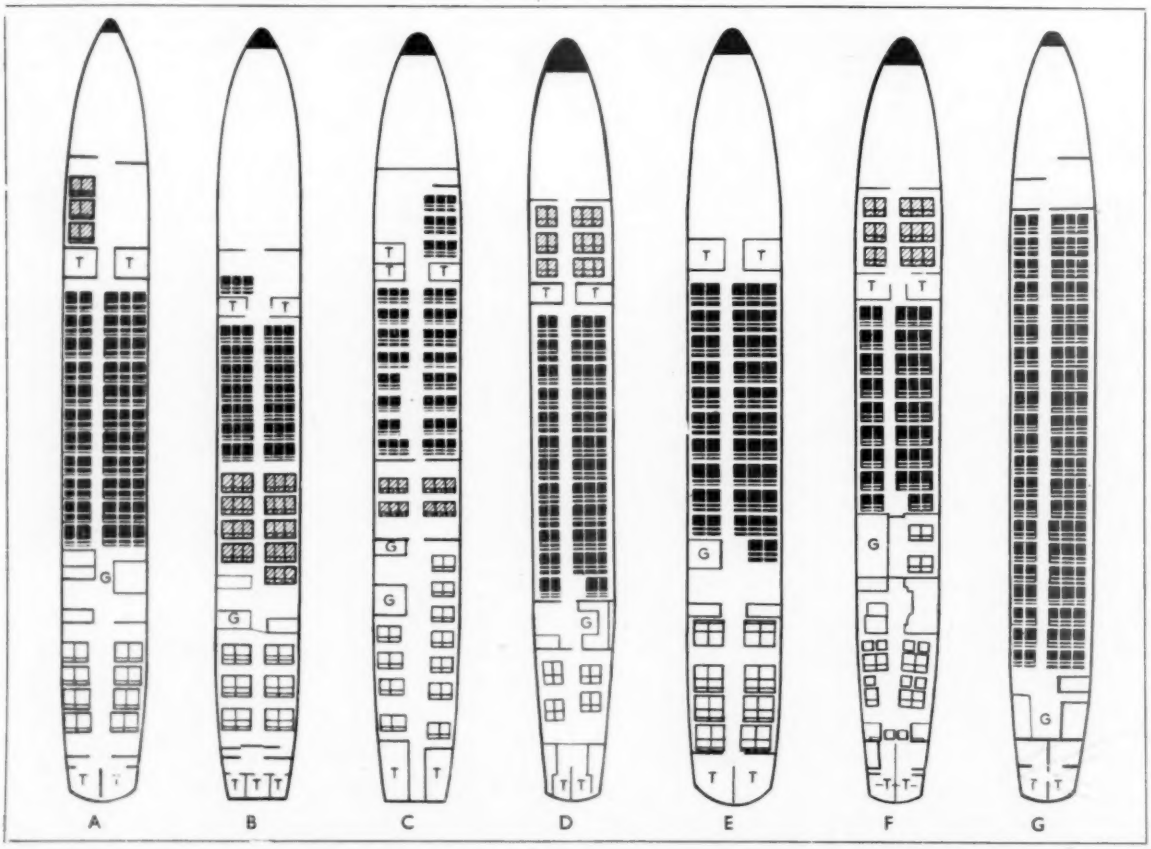
S.A.S.—At summer peak, 12 flights a week by all-economy DC-6B seating 81; four flights a week by all-economy DC-7C seating 85; and 14 flights a week by DC-7C with 28 first (rear) and 34 economy seats. Peak total, 1,788 economy seats a week.

Sabena.—Fourteen flights a week by DC-7C with 16 first, 10 tourist and 48 economy seats, and seven all-economy flights by L-1049G Super Constellation seating 97. Total, 1,367 economy seats per week.

Swissair.—Eight services a week by DC-7C with 14 first (rear), four tourist and 57 economy seats. Three services a week by DC-6B with 16 first and 52 economy seats. Peak total, 612 economy seats per week.

T.C.A.—At summer peak, 15 services a week by L-1049G Super Constellation with 7 de luxe (rear), 4 first-class (rear), 15 tourist (forward) and 44 economy (main cabin) seats. Peak total, 660 economy seats per week.

T.W.A.—Commencing April 1, 11 flights a week by Starliner (including two on Arctic route to West Coast) with six de luxe (rear), eight first-class and 60 economy seats. Seven flights a week by L-1049 Super Constellation with 103 economy seats. Total initial offering, 1,381 economy seats per week. Peak total offering, about 3,500 economy seats per week.



Seven varied configurations to be used by the airlines introducing economy class on April 1. In each case the economy seats are shown in solid black and tourist seats are shaded. G=galley area; T=toilet. The drawings show: A, Alitalia-L.A.I. DC-7; B, B.O.A.C. Britannia; C, tentative scheme for C.P.A.L. Britannia; D, Lufthansa Starliner; E, Swissair DC-6B; F, T.C.A. Super Constellation; G, T.W.A. Super Constellation.

THE FIGHTING SERVICES

Malayan Helicopter Squadrons

AIR MARSHAL THE EARL OF BANDON, C.-in-C., Far East Air Force, has presented No. 155 Squadron (Sqn. Ldr. R. C. Penning), equipped with Whirlwinds, and No. 194 Squadron (Sqn. Ldr. F. Barnes), operating Sycamores, with silver replicas of their aircraft in recognition of their work in support of the anti-terrorist operations in Malaya.

Westland Aircraft, Ltd., has made the donation to No. 155 Squadron to mark its unprecedented achievements in air-lifting 50,000 troops and completing 15,000 operational flying hours between December, 1954, and March, 1958. Since it was re-formed in 1954 under Sqn. Ldr. L. L. Harland, D.F.C., No. 155 has lifted nearly 750,000 lb. of freight and evacuated from the jungle 369 military and civil wounded and the bodies of the terrorists and Security Forces personnel killed in action. The Squadron has also parachuted 11,000 lb. of supplies to jungle encampments and dropped 800 troops of No. 22 Special Air Service Regiment.

The silver model for No. 194 Squadron has been presented by the Bristol Aeroplane Co., Ltd., for logging over 20,000 operational hours between February 1, 1953, and February 21, 1958. Re-formed with Dragonflys as the first R.A.F. helicopter squadron, it obtained the nucleus of its personnel from the helicopter Casualty Evacuation Flight then operating in Malaya. Re-equipped with Sycamores in the autumn of 1954, No. 194 Squadron has air-lifted over 15,000 troops, nearly 500,000 lb. of freight, and 2,275 casualties in approximately 39,400 sorties involving 20,300 hours' flying.

R.A.F. Staff Appointments

AIR COMMODORE W. P. Sutcliffe, D.F.C., is to become Director of Intelligence at the Air Ministry this month. Since 1945 he has served at Headquarters, Bomber Command, the R.A.F. Staff College, Bracknell, No. 3 (Bomber) Group as Senior Air Staff Officer, and at the Air Ministry.

Group Captain C. C. Morton, C.B.E., Deputy Director of Signals (A) at the Air Ministry since 1956, has been appointed Deputy Chief Signals Officer, Signals Division, SHAPE, with the acting rank of Air Cdre. Since 1953 Gp. Capt. Morton has commanded the Inter-Communications Support Group at Allied Forces Central Europe, Fontainebleau, and been Inspector of Radio Services.

Enthusiasm for Flying

THE recent request by the Air Training Corps for week-end pilots to fly Chipmunks (THE AEROPLANE of March 21) brought in a quick response. Within a few hours of the ministerial announcement that 50 Chipmunks were to be transferred from the R.A.F. to the Air Training Corps to augment air-experience flying, requests for enrolment as pilots in the training branch of the R.A.F.V.R. were being received by Headquarters, Home Command, from ex-R.A.F. and ex-R.Aux.A.F. pilots, many with current civil licences.

Some 150 pilots will be needed to fly A.T.C. cadets at week-ends and during annual camp periods, when they will receive full pay of their rank for limited periods. Week-end flying will be voluntary, but out-of-pocket expenses will be paid. Volunteers are being placed on a register and selection is expected to start soon. Some volunteers will be required to undergo medical examination, refresher and a final check before qualifying to fly cadets as passengers.

Photograph copyright "The Aeroplane"

SOCIAL OCCASION.—A farewell party to the present Director-General of Equipment, Air Vice-Marshal H. D. Jackman, who is A.O.C.-in-C. (designate) of Maintenance Command, (on the left, with Mrs. Jackman) and to welcome his successor, Air Vice-Marshal G. L. Worthington, seen with Mrs. Worthington, was held in London last week. Guests included Mr. and Mrs. Charles Orr-Ewing and Air Chief Marshal Sir Walter Dawson and Lady Dawson.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Wing Commanders: N. Briggs, A.F.C., to R.A.F. Akrotiri, Cyprus, for administrative duties; E. R. H. Caven to R.A.F. Jurby for administrative duties; E. W. Deacon, D.S.O., D.F.C., A.F.C., to H.Q. No. 19 Group, for Air Staff duties; W. T. Ellis, A.F.C., to No. 5 M.U., to command; A. Fry, M.B.E., to Air Ministry for duty in the Department of the Air Member for Supply and Organization; S. C. Ladyman to R.A.F. Shawbury to command the Administrative Wing; R. G. K. Smith to the U.S.A.F. Armament Development Centre on exchange duties; R. Stevenson to A.A.F.C.E. for staff duties; D. J. Walliker to Air Ministry for duty in the Department of the Air Member for Supply and Organization.

Squadron Leaders: J. L. Aron, M.B.E., to Air Ministry Unit for accounts duties (with acting rank of Wg. Cdr.); C. A. Rennie, D.F.M., to H.Q. 2nd A.T.A.F. for staff duties (with acting rank of Wg. Cdr.).

LATEST MARK. — A Gloster Javelin FAW.6 of No. 89 Squadron at R.A.F. Stradishall, the latest mark to join Fighter Command's all-weather force. Powered by two Armstrong Siddeley Sapphire 100s, the Javelin 6 has internal modifications compared with the FAW.4s and 2s in service.

Photograph copyright "The Aeroplane"

THE FUTURE and THE ROYAL AIR FORCE

ON April 1 this year, the Royal Air Force is 40 years old. A birthday is always a good time to stop and think—to reflect on the past, to take stock of the present and to look forward into the future. In this special Anniversary Celebration number, THE AEROPLANE has provided us with an excellent opportunity to do this, and I would like to say on behalf of the Royal Air Force how greatly we appreciate it. In this issue, you will find special features on the work of the individual Commands—thus providing the look to the past and the present. What of the future?

Today the Royal Air Force faces a great challenge—the challenge of strategic and technical changes even more far-reaching and fundamental than those we have already successfully dealt with in our short but eventful history. I am confident that, as in the past, the Service will meet this challenge with boldness, courage and imagination and will not be found wanting.

What makes the new challenge particularly difficult is that, sweeping as are some of its implications, it does not and cannot completely alter the existing picture. As always before in the history of warfare and defence, the present changes do not sweep away all that has gone before. In themselves they are essentially evolutionary and not revolutionary. And we must also remember that, although we must prepare and equip ourselves for the shape of things to come, we must at the same time retain the ability to deal with situations very little different from those we have been accustomed to in the recent past.

This dilemma is the crux of our problem in deciding on the future equipment of the Royal Air Force and it is a dilemma which becomes acute because of the limitations of men, money and material imposed by the nation's economic position and by the length of time it takes to develop new weapons. Against this background, I would like to picture for you the various rôles of the Royal Air Force, as I see them, during the next decade as we progress from our 40th to our 50th Anniversary.

The Deterrent

First—the deterrent force. Her Majesty's Government has made it clear in successive Defence White Papers that the first preoccupation of the United Kingdom must be to prevent global war. This is the essence of self-preservation and the prerequisite of all else. Her Majesty's Government's Defence Policy therefore rests firmly on that of the nuclear deterrent to war and it is in my view this power which is the essential basis of all other power, and that without it our remaining sea, land and air forces would be of little avail. It is the pride and privilege of the Royal Air Force to wield this country's nuclear deterrent power and in so doing to stand in the forefront of the country's defence.

Now, and for many years to come, the British deterrent force will be provided by the V-bombers of Bomber Command, whose strength is rapidly growing, at first carrying free-falling megaton bombs but later carrying powered guided bombs which can be released outside the enemy defences. The V-bomber force, with its dispersed bases and the possibilities inherent in flight refuelling will be a flexible and mobile instrument of power which will present a valid deterrent to our enemies for very many years to come. It should also not be forgotten that the V-bombers can carry a heavy load of H.E. bombs as an alternative to nuclear weapons and that their mobility and long range make them flexible instruments of power for limited hostilities, for reinforcement overseas in times of crises, and for "flag-showing" flights in times of peace. In fact for flexibility, economy of effort and value for money, the V-bomber force stands supreme in Britain's armoury.

Supplementing the V-bombers—complementary to them but not necessarily replacing them—we hope to have later on a British Intermediate Range Ballistic Missile. One of the most important features of this weapon is that it will be sited underground and will thereby become the first "hard" deterrent weapon—by that I mean its operation will not necessarily be governed by the necessity for it to be launched before enemy attack. The ability of such a weapon to withstand all but a direct hit will face the potential aggressors with the realization that even a surprise attack would not save him from massive—and unacceptable—retaliation.

In the interim period before we get our own British I.R.B.M., Bomber Command will be operating the American missile, Thor. This is subject to joint Anglo-U.S. control and will form a valuable addition to the Western deterrent forces; it will also give Bomber Command personnel valuable experience in the missile field before our own become available.

The R.A.F. is entering the "missile business" with the same vigour, forward-looking spirit and sense of adventure as, in the past, we have tackled other radical changes from the conventional, but I do not myself believe that the unmanned missile is the end of the story. One of these days I think we shall see the manned vehicle—at present over the horizon but sooner or later bound to appear—which can reconcile the concepts of the supersonic bomber and the manned satellite. Such a vehicle might be capable of flying about the earth outside the atmosphere a hundred miles up, and returning to earth

at will. I believe that in such craft we shall see the first steps to the controlled conquest of the space immediately surrounding our world and I believe, too, that this country cannot afford to stand aside from all part in their development.

The Importance of Fighter Command

Let us now turn from Bomber Command to Fighter Command. So much has been said and written lately prophesying the imminent abolition of the fighter element of this Command that I must say straightaway that such rumours are quite without foundation. Let me try to put the problem in correct perspective. As we pass from threat of attack by supersonic bombers to attack by ballistic missiles—and that will not be for some years yet—it is clear that the form of defence which holds out the greatest hope is one by some form of surface-to-air guided weapon system, though there are very formidable problems still to be overcome. Fighter Command is being re-equipped with S.A.G.W. and I have no doubt that the same sort of defence will ultimately be required for our major overseas bases. On the other hand, it is equally clear that some defence by manned fighters will as far as can be foreseen be necessary to counter enemy reconnaissance aircraft and stand-off jammers.

I myself cannot foresee the day when manned fighters can be entirely dispensed with either at home or overseas —particularly so in the latter case where the limited conflicts are likely to be fought in the future with " last generation " or " last generation but one " weapons. As increasing numbers of countries are acquiring large numbers of obsolescent, but nevertheless high-performance, Russian aircraft; this is a problem which will have to be faced.

Coming to tactical aircraft it seems clear that we shall have a requirement for many years ahead for a high-performance long-range reconnaissance/strike aircraft capable of acting in a variety of rôles—doing, in fact, what the Canberra does today. Such aircraft would form the bulk of our contribution of tactical atomic bombers to the N.A.T.O. Shield Forces and they would also be invaluable for the many tasks which would still have to be performed in our overseas commands. They would have to be capable of using relatively short runways and of high-speed operations low down over long distances. These aircraft, as I see it, would be the main " general purpose " aircraft of the R.A.F.

Air Transport's Vital Rôle

Probably the least controversial of all the R.A.F.'s rôles is that of air transport. As far as we can see ahead, air transport has a vital rôle to play in peace and war, not only moving Army and Air Force reserves to those areas where they are needed in time of crisis but acting in several different ways as the maid-of-all-work of the Services. We need personnel and freight carriers capable of flying very long distances when intermediate bases are denied to us and also intra-theatre aircraft capable of operating from small, rough airstrips. The competitive pressure of technical progress is perhaps not quite so great with transport aircraft as with others, but here again we must think well ahead to the time when nuclear-powered aircraft, with a vertical take-off capability, will reduce our present reliance on large airfields and long runways and on intermediate refuelling bases.

Last but not least, I must say a word about our maritime aircraft which play an important rôle in contributing to the N.A.T.O. Shield Forces and which have a versatility and long-range capability that make them invaluable for a variety of secondary rôles. Maritime aircraft are not likely to become obsolete quite so quickly as those for other rôles, and we are perhaps more likely to see development in the special equipment they carry rather than in the aircraft.

It will be clear from what I have written that the rôle of the R.A.F. in the future is likely to be even more varied and important than in the past, and that there are no grounds for the doubts and rumours which have been so unfortunately, and so misleadingly, sown about it. I firmly believe the young man of tomorrow, whether his bent be towards flying and adventure, or towards science and technology, will find the same sense of fulfilment and high purpose in the R.A.F. of the future as his predecessors did in the past and still do today.

I am often reminded of the aptness of that old saying, " The more things change the more they stay as they are." How true that is when applied to human beings and human endeavour. The human qualities required in this present age of great scientific achievement are the same as those which were needed at the birth of the Royal Air Force and which have sustained it throughout its life. Such qualities are changeless and it is a source of comfort and pride that the Royal Air Force has never lacked an abundance of them. I am confident that now as we graduate to our new weapons and shoulder our tremendous responsibilities for the continuing safety of this country, we shall still find the young men that we need with the strength of purpose and the breadth of vision to enable us to achieve our task.

It is, perhaps, ironical to think that, at a time when science is seeking to put the emphasis more and more on the unmanned missile and the guided weapon, I should stress the need for men of high calibre to come into the Royal Air Force. But there is no doubt whatsoever in my mind that it is in the strength of character of her men that the Royal Air Force will retain and enhance her greatness.

By Marshal of the Royal Air Force

Sir Dermot A. Boyle, G.C.B., K.C.V.O., K.B.E., A.F.C.

Chief of the Air Staff

R.A.F. 40th Anniversary . . . .

The Royal Air Force Today

On this and the following 20 pages we survey the present-day organization, activities and equipment of the home and overseas components of the Royal Air Force. We deal first with the eight Commands in the United Kingdom and then with the Middle East and Far East Air Forces and the 2nd Tactical Air Force in Germany.

Bomber Command

Air Chief Marshal Sir Harry Broadhurst, K.C.B., K.B.E., D.S.O., D.F.C., A.F.C., Air Officer Commanding-in-Chief, Bomber Command.

EQUIPPED with its full complement of Vickers Valiants, an increasing number of Avro Vulcans, and receiving the first of its Handley Page Victors earlier this year, Bomber Command has an expanding and operational nuclear potential, which, with its Canberra force, is the United Kingdom's main deterrent against a third World War. To increase the power and strength of the Western defences in the event of a future conflict, Bomber Command is committed to operate in conjunction with the U.S. Strategic Air Command, and its Canberras are assigned to the Supreme Allied Commander Europe as a tactical force for the defence of the Continent.

These main responsibilities of Bomber Command make the primary task of the A.O.C.-in-C., Air Chief Marshal Sir Harry Broadhurst, the maintenance of his V-bomber squadrons as an effective striking force. In addition, the Command has the secondary rôles of reinforcing our overseas territories in the event of limited wars; "showing the flag" about the World; photographic reconnaissance for various Government departments (such as the recent aerial survey of the entire Aden Colony and Protectorate for the Colonial Office), and the responsibility for sea-mining and anti-shipping missions.

To provide the best possible protection for this country the main requirement of the Bomber Command deterrent force is a high degree of readiness which will become progressively more important as we move towards the missile era. This, coupled with good dispersal and early alerting by Fighter Command, would give the nuclear deterrent the highest possible chance of striking back before it was attacked.

Bomber Command bases throughout the U.K. are divided into two Groups which come under the direct control of its Headquarters at High Wycombe. No. 1 Group at Bawtry is responsible for the Canberra force and the Vulcan squadrons, and No. 3 Group, with Headquarters at Mildenhall, has the operational Valiant and future Victor squadrons.

In addition, each Group controls the training of its own forces and is also responsible for a number of other establishments in the Command. The Command Bombing School at R.A.F. Lindholme; No. 231 Operational Conversion Unit for Canberra crews at Bassingbourn, and the Vulcan O.C.U.—No. 230—at Waddington are under the command of No. 1 Group. From Mildenhall No. 3 Group has the Central Reconnaissance Establishment, Brampton, and its photographic-reconnaissance squadrons at R.A.F. Wyton, and No. 323 Victor/Valiant O.C.U. at Gaydon.

The Canberra force was originally distributed throughout the whole Command but has recently been moved, except for some P.R. squadrons, into No. 1 Group and concentrated into a smaller number of larger units, such as the Wing at R.A.F. Upwood. The size of this force is slowly being reduced as more V-bomber squadrons become operational, and the number of aircrews requiring training at the Bassingbourn O.C.U. has decreased accordingly.

Operated by Bomber Command since May, 1956, initially with No. 230 O.C.U., and then with No. 83 Squadron at Waddington, the Vulcan has now been issued to a second squadron—No. 101—which was re-formed at R.A.F. Finningley earlier this year. During 1957 No. 83 Squadron crews won four awards in the annual Bomber Command bombing and navigation competition with their Vulcans, including the Lawrence Minot Trophy for combined bombing and navigation, and the Sir Philip Sassoon Trophy for navigation.

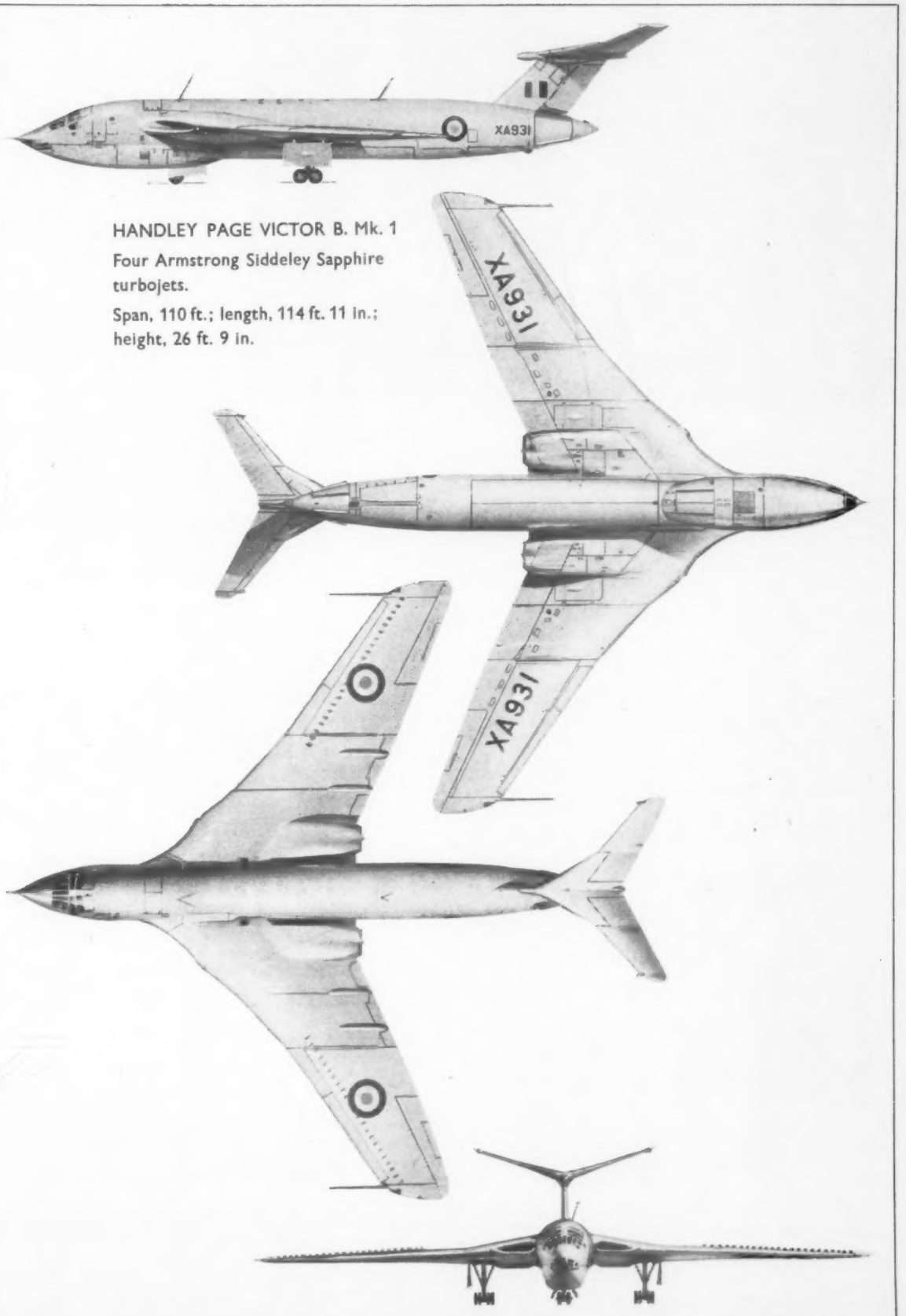
As the first of the V-bombers to enter service, Valiants are now operated by the majority of squadrons in No. 3 Group, some of which are equipped for additional tasks besides the bomber rôle, such as tanker and reconnaissance aircraft, the latest version being the Valiant B(PR)K. All Valiants in service can be modified to supply or receive fuel in flight.

Valiants of this type, together with Canberra PR.3s and PR.7s, form the equipment of the photographic-reconnaissance squadrons at R.A.F. Wyton, the strategical P.R. element of Bomber Command directly controlled by the Central Reconnaissance Establishment. Covering the long-range P.R. requirements of the three Services, plus civilian needs in peacetime, the Valiant B(PR)Ks are employed on high-level normal and radar reconnaissance, and the various P.R. marks of Canberra

(*Continued on page* 420)

An English Electric Canberra B.6, the Command's standard light bomber. Other marks of the Canberra in service include PR.3s and PR.7s, which are with the strategical photographic reconnaissance element at R.A.F. Wyton.

Photograph copyright "The Aeroplane"



HANDLEY PAGE VICTOR B. Mk. 1

Four Armstrong Siddeley Sapphire turbojets.

Span, 110 ft.; length, 114 ft. 11 in.; height, 26 ft. 9 in.

"The Aeroplane" copyright drawing by Roy Cross

The three types—Vickers Valiant, Avro Vulcan and Handley Page Victor — constituting the V-bomber force, are now in service with Bomber Command. Here, a Vulcan is seen leading a mixed Vic with a Valiant on its left and the first Victor (XA 931) to go to Gaydon, on its right.

(*Continued from page* 418)

are used for both high- and low-level missions. Both types are suitable for night operations.

Night P.R. is a method of extending the life of these aircraft, in particular the Canberra, because of the lower chances of enemy interception. Limitations to operating heights in this field are brought about by illumination problems and not the aircraft, or its cameras.

Last of the V-bombers, the Victor B.1, is now at the O.C.U. at Gaydon and formation of the first squadron is expected before the end of the year. Powered by four Armstrong Siddeley Sapphires, it carries a standard crew of five—captain, co-pilot, two navigators and an Air Electronics Officer.

Because of the need for the highest possible standard of operation if the maximum potential use of the V-bombers is to be obtained, the selection and training of their aircrew is a vital factor. Also, the length of time needed to produce a fully operational crew is such that the intention is that they should complete, where possible, a five-year tour with the force, followed by a short period in the reserve.

For selection as a V-bomber captain a pilot must possess an " above average " flying rating and have generally flown at least 1,750 hr. as first pilot. He must have also completed a squadron tour flying Canberras. Co-pilots are required to have a minimum of 700 hr. in command, normally including a tour on Canberras, which will give them experience of Bomber Command operations.

A Canberra tour is also required for selection as a V-bomber navigator, and navigator bomb-aimers receive their advance training at Command Bombing School, Lindholme. Air Electronics Officers, the fifth member of a Valiant, Vulcan or Victor crew, are trained at the Air Electronics School at Hullavington before going to an O.C.U. for operational crew selection. This last category was created to meet the requirement for an aircrew officer capable of operating the aircraft's electronic and electrical systems including radar counter measures and communications equipment.

Bomber Command operational crew training includes briefing for the specific missions they would undertake in the event of a major war, coupled with instruction in synthetic trainers. Actual bombing accuracy of the crews is assessed by ground radar tracking of the bomber over special ranges. Overseas training flights are made both by single aircraft operating on " Lone Ranger " exercises and by squadron formations.

The R.A.F. Today—Fighter Command

Air Chief Marshal Sir Thomas G. Pike, K.C.B., C.B.E., D.F.C., Air Officer Commanding-in-Chief, Fighter Command.

CHARGED with the primary task of alerting and defending the V-bomber bases in the United Kingdom so that our nuclear deterrent could strike back before it was attacked, coupled with the overall air defence of this country, Fighter Command is now in the process of having internal alterations made to its structure as part of the plan to provide a more streamlined organization. These changes, together with the reduction of the fighter force which will be completed during this year, are designed to produce a higher degree of efficiency while considerable savings in manpower and overall costs are made.

To achieve this, modifications to the Command's early-warning and fighter-control organization have been gradually introduced. The functions of the Sector Operations Centres have been reorganized at comprehensive radar stations equipped with every type of control and reporting radar, and the Fighter Command early-warning system is now operating on a 24-hr. seven-day-a-week basis. In addition, group headquarters have been transferred, or will be in the very near future, to new locations within easy reach of their comprehensive radar stations, so that the Group Commander has the current air situation directly available, should he require it during the air battle.

With these developments a greater accent is being put on having a larger proportion of the defence force available at any particular moment, and to help obtain this, and a higher readiness state, the main object of training has changed slightly. Instead of putting individual crew training first, although this obviously remains an important factor, the prominence has been transferred to a more complete work-up of the ground-radar/airborne fighter team.

This reduction in the number of steps in the control and reporting chain between the radar displays and the Group Commander brought about by the introduction of the comprehensive radar stations has eliminated the need for the original Sector control, and allowed changes to be made in the operational and administrative organization of the Command. The reduction in the number of fighter squadrons has also brought changes.

The training Group—No. 81—has been disbanded and its commitments transferred to the operational Groups—Nos. 11, 12 and 13. These include the Day Fighter Operational Conversion Unit equipped with Hunters at R.A.F. Chivenor, and No. 238 O.C.U. at Leeming for all-weather fighter crews, operating Meteor night-fighters and Javelins. The Sectors within the three Groups—Southern and Metropolitan in No. 11;

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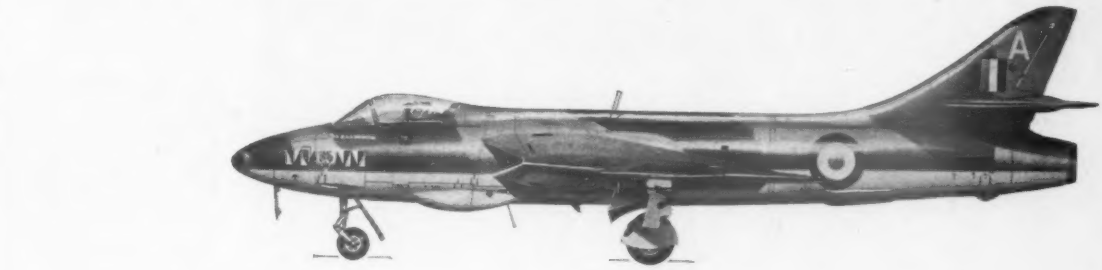
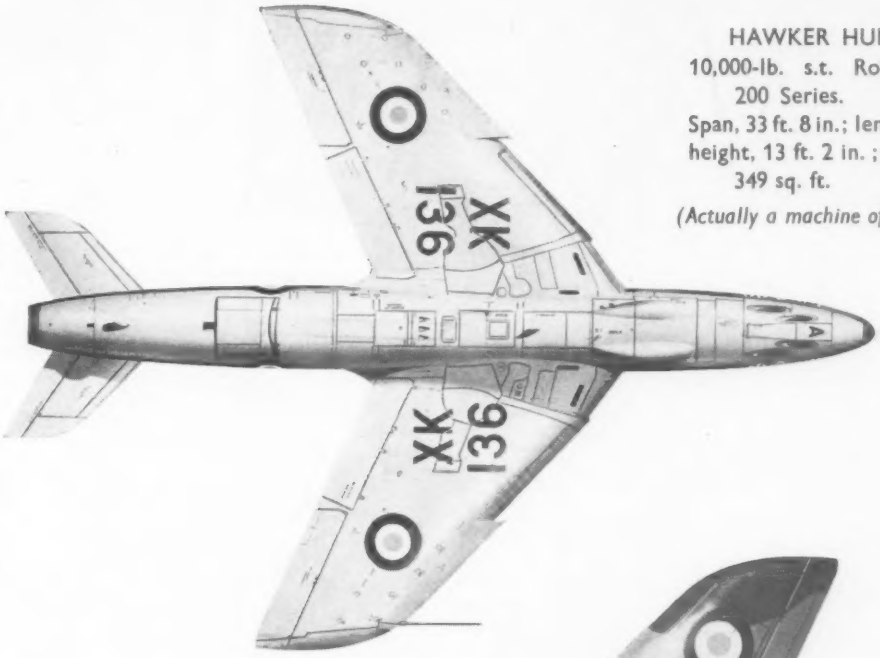


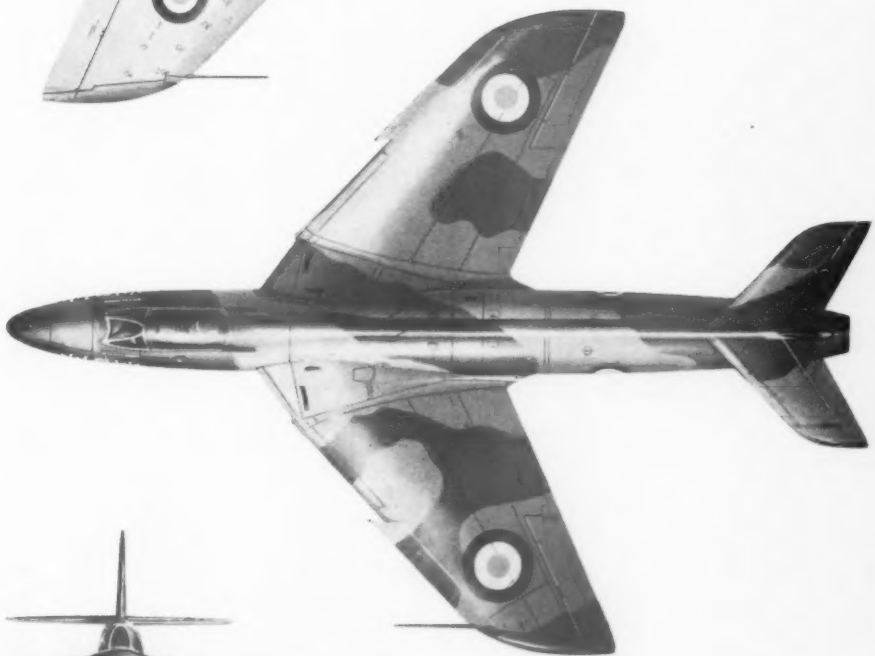


HAWKER HUNTER F.Mk.6

10,000-lb. s.t. Rolls - Royce Avon 200 Series.

Span, 33 ft. 8 in.; length, 45 ft. 10½ in., height, 13 ft. 2 in.; gross wing area, 349 sq. ft.

(Actually a machine of No. 74 Squadron.)



"The Aeroplane" copyright drawing by Roy Cross

A Gloster Javelin FAW.6 of No. 89 Squadron at R.A.F. Stradishall. This is the latest mark of the all-weather fighter to go into service with Fighter Command.

Photograph copyright "The Aeroplane"

(*Continued from page* 420)

Eastern and Western in No. 12, and Northern and Caledonian in No. 13—have also gone.

R.A.F. Middle Wallop, which was the home of the Joint Experimental Helicopter Unit, has become the centre of the newly formed Army Air Corps, but the School of Land/Air Warfare at R.A.F. Old Sarum is still in No. 11 Group. The Guided Weapons Development Flight at Valley is controlled by No. 12 Group and Fighter Command's School of Fighter Control is now at Hope Cove, a non-operational G.C.I. station. In time this establishment and the School of Fighter Plotting are to be combined at one station.

The centre of all developments in fighter techniques is still the Central Fighter Establishment at West Raynham, which also standardizes the operating methods of the squadrons. C.F.E. trains the Command's fighter leaders at its Day Fighter Leader School and assesses new aircraft and equipment for operational requirements. The Command's surface-to-air guided weapons station at North Coates, Lincolnshire, is now almost completed and work on other S.A.G.W. stations is to start soon.

At fighter station level the basic principle of a mixed force of day- and night-fighter squadrons in the same Wing still holds good, although the original ratio of one night to two day squadrons is not necessarily now the case. To implement this policy the smaller stations unsuitable for present-day operational requirements are being closed and their squadrons disbanded or redeployed.

Almost all day-fighter squadrons are now operating Hawker Hunter 6s, and an increasing percentage of the all-weather fighter force is being equipped with Gloster Javelin 4s and 6s. Replacing the Meteor NF. 14s, which are being phased-out, the later marks of Javelin have also superseded the small number of Mk. Is that were in service. For training and pilot instrument ratings, Fighter Command is still employing a mixed bag of Meteor 7s and Vampire T.11s.

Later this year the Javelin FAW.7, equipped with D.H. Firestreak air-to-air missiles, is to be introduced into service. Powered by two Armstrong Siddeley 200-series Sapphires, as opposed to the 100-series in the Javelin 4 and 6, the Mk. 7 has an all-flying tail and a number of internal modifications. The Javelin 4 is similar to the Mk. 1 but has an all-flying tail; the Mk. 6 also has internal modifications over the earlier versions and is fitted with later radar.

Service trials of the first ground-to-air guided weapons system for Fighter Command—the Bristol Bloodhound—are due to start, or have started, at North Coates. These trials are designed to test the complete control systems, including the various radar units, up to the actual point of firing, and will be used to establish the handling and maintenance procedures for the missile, together with its co-ordination with the fighter defence system.

The majority of new pilots entering the Command from Flying Training Command complete the 2½-month Hunter conversion and tactical training course at the O.C.U. at Chivenor before starting a tour (2½ years) with a day-fighter squadron. On completion of this they transfer either to another Command, such as Bomber, or go to the all-weather O.C.U. at Leeming for the four-month conversion course on to Javelins. Because of the longer training required for all-weather operations Javelin crews (pilot and navigator/radar operator) are going over to an extended tour of approximately four years.

Fighter Command's whole responsibility for search and rescue operations along the east coast have been taken over by Coastal Command, which now operates the S.A.R. organization.

The majority of day-fighter squadrons operating in the United Kingdom are now equipped with Hawker Hunter 6s. On the right is a mark 6 of No. 92 Squadron at R.A.F. Thornaby.

The R.A.F. Today——————————Coastal Command

Air Marshal Sir Bryan V. Reynolds, K.C.B., C.B.E., Air Officer Commanding-in-Chief, Coastal Command.

FROM his Headquarters at Northwood, the Air Officer Commanding-in-Chief, Coastal Command, Air Marshal Sir Bryan Reynolds, is responsible for maintaining his forces at the highest possible standard of efficiency, and with the Royal Navy is charged with the safeguarding of sea communications in the Atlantic and British Home Waters. In addition, the Command has the secondary rôle of meteorological reconnaissance over the Atlantic, and in a limited war, can be called upon to assist Transport Command in emergency trooping operations.

Divided into geographical areas, the Command is now made up of three, instead of four, components. Two Groups in the United Kingdom—Nos. 18 and 19—and R.A.F. Gibraltar. The fourth unit, Maritime Air Headquarters, Chatham, has been disbanded.

Besides its national commitments, Coastal Command is closely tied up with NATO and the A.O.C.-in-C., and the A.O.C., No. 18 Group, Air Vice-Marshal P. D. Cracroft, C.B., A.F.C., and the A.O.C., No. 19 Group, Air Vice-Marshal G. I. L. Saye, C.B., O.B.E., A.F.C., hold a number of posts in the Organization. Air Marshal Sir Bryan Reynolds is Air C.-in-C., Eastern Atlantic Area, and Allied Maritime Air C.-in-C., Channel Command. Air Vice-Marshal Cracroft is also Commander Air Northern Sub-Area, Eastern Atlantic, and Air Vice-Marshal Saye is Commander Air Central Sub-Area, Eastern Atlantic, and Commander Air Plymouth for the Channel Command.

No. 18 Group, with its Headquarters at Pitreavie, Fifeshire, controls the Shackleton squadrons and Marine Craft Units in its area and also the Maritime Operational Conversion Unit, equipped with Shackleton 1s, 2s and T.4s, at R.A.F. Kinloss. No. 19 Group at Mount Batten has the Shackleton squadrons and Marine Craft Units in the south, together with the R.A.F. Search and Rescue Organization which Coastal has taken over from Fighter Command. S.A.R. helicopters—Sycamores and Whirlwinds—are now dispersed in pairs at nine locations around the coast and are at 15-min. readiness from dawn to dusk.

The maritime meteorological reconnaissance duties of Coastal Command are undertaken by No. 202 Squadron, equipped with Hastings, at Aldergrove, Northern Ireland. Another of the Command's interests is the Joint Anti-Submarine School at Londonderry which it shares with the Royal Navy. Here, experienced squadron aircrews receive training in advance anti-submarine work.

For its main task of helping maintain the sea communications of this island in the North Sea and Eastern Atlantic, Coastal Command is exclusively operating Shackletons, and one squadron—No. 220 at St. Eval—has been re-equipped with Mk. 3s and another is in the process of converting. The Lockheed Neptunes that the Command had on loan from the U.S. were returned last year, and there are now no Sunderlands, nor with the closing of Pembroke Dock, flying-boat facilities, in this country. The sole surviving Sunderland unit in the R.A.F. is No. 205/209 Squadron at R.A.F. Seletar, Singapore, which is all that remains of the Far East Air Force Flying Boat Wing.

A development of the Mk. 2, the Shackleton MR.3 has nose wheel landing gear, improved radar plotting and navigation facilities and a number of other internal changes to make it a generally quieter aircraft to reduce aircrew fatigue. Powered by four 2,450-h.p. Rolls-Royce Griffon liquid-cooled engines, the Mk. 3 is operated by a crew of 10; two pilots, two navigators, five radio/radar operators and one flight engineer.

Other changes in the Shackleton MR.3 over the earlier marks include an increased fuel capacity incorporating wing-tip tanks and a new clear-vision cockpit canopy. First flown in September, 1955, the Mk. 3 is also in service with the South African Air Force, which recently received the last of its 10 aircraft from Avro's. A total of four Coastal Command squadrons is to be re-equipped with this mark.

The majority of Shackleton captains and 1st navigators are experienced aircrew who have completed at least one tour of duty in the Command. Co-pilots and 2nd navigators are normally first-tour personnel from Flying Training Command, but, as opposed to Transport Command, all co-pilots or 2nd pilots are qualified on type when they leave the O.C.U. at Kinloss. Air Electronics Officers are now posted to Coastal Command squadrons to co-ordinate and train the radio/radar operators, and actually hunt down a submarine once it has been detected by a member of their team in a Shackleton.

Responsibility for co-ordinating search and rescue operations has been allocated to both Nos. 18 and 19 Groups. These Groups control Rescue Co-ordination Centres located at Rosyth and Plymouth respectively, which are usually alerted by A.T.C.C.s when an aircraft is overdue or has sent out an emergency call. With the increase in the number of helicopters

A Shackleton MR.3 of No. 220 Squadron at R.A.F. St. Eval, one of the two Coastal Command squadrons operating the latest mark of this type. The Shackleton is the only aircraft now used for long-range patrols over the Atlantic.

Photograph copyright "The Aeroplane"

A Westland Whirlwind of the Coastal Command Search and Rescue Organization, which is divided between Nos. 18 and 19 Groups.

being employed on search and rescue operations, coupled with the issuing of VHF communications equipment to R.N.L.I. lifeboats, the number of R.A.F. high-speed launches operating on air/sea rescue duties is being reduced. All S.A.R. launches remaining will be capable of undertaking target-towing as a secondary rôle.

The number of Shackletons on immediate stand-by for long-range search and rescue has been reduced to one, while a second Shackleton airborne on normal training is at immediate recall should the need arise. Capable of searching for approximately 3 hr. at a range of 750 miles from its base, the S.A.R. aircraft is officially at 1½ hr. notice, but under normal circumstances will always be airborne well ahead of this time. If an emergency is anticipated this Shackleton will be brought to "immediate readiness" and can then be off within a matter of minutes.

As Coastal Command is very closely linked with other NATO countries and the Royal Navy, a tight liaison is maintained with the Admiralty and West European air and sea forces, plus the U.S. and Canada, at all times. This affects many aspects of its work, including training, which is divided into two sections. The majority of operational exercises are undertaken and controlled by NATO, but individual aircrew training is made a domestic responsibility and organized by Coastal Command.

To maintain the highest possible operational efficiency and to have the greatest number of aircraft ready and serviceable at any one moment, Coastal Command is placing the emphasis on improving technical servicing on the ground, as well as obtaining a high standard of flying.

Photograph copyright "The Aeroplane"

The number of R.A.F. launches operating on air/sea rescue operations is being reduced and those remaining will also be used for target towing.

The R.A.F. Today——————**Transport Command**

Air Marshal Sir Andrew McKee, K.C.B., C.B.E., D.S.O., D.F.C., A.F.C., Air Officer Commanding-in-Chief, Transport Command.

THE idea that Transport Command is the airline of the R.A.F. operating a large number of scheduled flights round the World for the three Services and certain Government departments, such as the Ministry of Supply, is far from the truth. Although it runs a small number of such services to the 2nd Tactical Air Force in Germany, the Middle East and Far East Air Forces, and to the Woomera rocket range in Australia, the Command is not trying to operate at a high overall intensity at all times, but rather to produce a maximum effort for short periods.

This is almost solely due to the fact that the main operational task of Transport Command is the rapid deployment of the United Kingdom Strategic Reserve in the event of an overseas emergency. For this rôle, flexibility, as well as a high state of readiness and maintenance, is the main goal if aircraft are to be assembled and available for deployment at short notice.

An example of training for this type of work is the recent air mobility exercise, "Quickstep," in which some of the Command's Hastings, Beverleys and a Comet were employed in the air movement, at short notice, of about 500 officers and men of the 24th Infantry Brigade from the U.K. to Idris, in North Africa. Flying from R.A.F. Lyneham in Hastings of Nos. 511 and 24 Squadrons and a Comet of No. 216 Squadron, and from Abingdon in five Beverleys of Nos. 30, 47 and 53 Squadrons, the advance elements of the Brigade, together with their equipment were, on arrival, deployed on Army training.

A very small-scale exercise, "Quickstep" and other such operations are very important in developing new techniques for air moves and improving the efficiency of both the flying and ground-planning sides of troop movements to any part of the World. The joint staff work and procedures involved in the execution of "Quickstep" apply equally for an air move to any command.

In addition to the scheduled route services, the subsidiary rôles of Transport Command include the support of the other R.A.F. operational commands on their overseas training missions (such as Bomber Command's team for the U.S.A.F. Strategic Air Command Bombing, Navigation and Reconnaissance Competition held at Pinecastle A.F.B., Florida, at the end of last year); the training of Army airborne forces; supply dropping; transport operations for the Army, including the tactical as well as strategical movement of troops, and the overall responsibility for the ferry of Service aircraft to overseas commands.

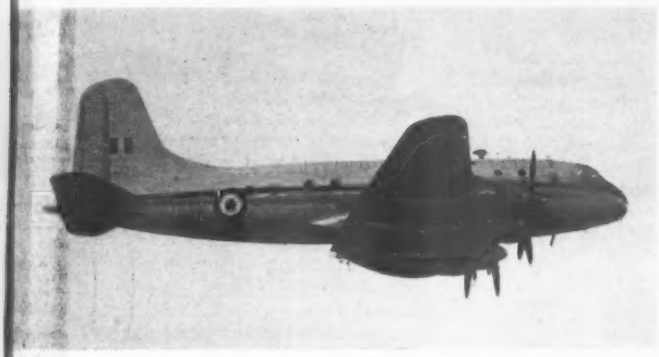
The majority of the regular trooping services are now operated by civilian contractors but special flights are the responsibility of the R.A.F. These cover V.I.P. work, M.o.S. requirements and good-will missions. All this shows the Command's change in commitments from regular to short-term high-intensity operations.

Responsible for all air transport services, both civil and

(*Continued on page* 425)

Right, the Blackburn Beverley, Transport Command's tactical short-range heavy-lift transport. Below, a Handley Page Hastings of the long-range force which is still used for a wide range of tasks throughout the World.

Photograph copyright "The Aeroplane"



(*Continued from page* 424)

military, which come under the jurisdiction of the Air Ministry, the A.O.C.-in-C., Air Marshal Sir Andrew McKee, at his Headquarters at Upavon, Wiltshire, does not, however, control the overseas staging posts. These are the responsibility of the particular command in which they are situated. To provide a tie-up and means of standardizing the work of these stations, and maintaining an overall check of their operations, the A.O.C.-in-C., Transport Command, also bears the title of Inspector of Air Transport Services.

In the United Kingdom the Command has two main operational bases, at Abingdon, Berkshire, and Lyneham, Wiltshire, and a third station, Dishforth, Yorkshire, which contains No. 242 Operational Conversion Unit for Hastings, Beverleys and Valettas, and No. 30 Squadron, equipped with Beverleys. It also controls the Communications Flight at R.A.F. Northolt, the Ferry Wing at R.A.F. Benson, Oxford, and No. 1 Parachute School, Abingdon.

Operational units at Abingdon are Nos. 47 and 53 Squadrons equipped with Beverleys, the tactical short-range heavy-lift transport aircraft. Powered by four 2,850-b.h.p. Centaurus 173s, it has a maximum take-off weight of 135,000 lb. and a total payload of 44,000 lb. At this payload, and including a 20% fuel reserve, the Beverley has a range of 200 miles, which goes up to 3,690 miles when the load is reduced to 1,000 lb. Flying at 8,000 ft., its still-air cruising speed varies between 145 and 188 m.p.h.

Flying the Beverley with a crew of four—captain, co-pilot, navigator and signaller—the squadrons have found that one air quartermaster is sufficient when carrying freight only, but the freight-passenger combination requires two quartermasters. At the normal R.A.F. maximum freight/passenger load of 32,000 lb. the transport can lift 92 completely equipped troops over a stage length of approximately 500 miles.

At Lyneham and its subsidiary airfield of Colerne are several squadrons of Hastings—Nos. 99, 24 and 511—which are used for the Command's scheduled services as well as special flights, and No. 216 Squadron equipped with 10 Comet 2s. As the high-speed element of the long-range force, No. 216 Squadron received its first Comet in June, 1956, and undertook its first operational task later that month when the Secretary of State for Air was carried to Russia. Since that date the Squadron has logged over 8,500 flying hours with its aircraft, including 78 crossings of the Atlantic and 26 times across the Pacific. At present running a weekly return service to the Task Force at the Christmas Island nuclear testing base, a total distance of 19,000 miles, the Squadron's Comets complete the round trip in a flying time of 45 hr. and an elapsed time of 90 hr.

The Hastings is still the most versatile of the Command's aircraft and with its 18,000-lb. payload over a range of around 1,500 miles will remain the standard all-round transport at least until the R.A.F. has its 20 Britannia 253s in service. At the present time Transport Command's strength is 30 Hastings, 10 Comets and 24 Beverleys, although these figures vary a great deal from time to time. The Service should start to receive its Britannias next year.

Approximately half of the Hastings force and a quarter of the Beverley fleet normally operate outside the U.K. The overall serviceability rate, with the squadrons undertaking their own first- and second-line servicing, is in the order of 75%.

Several ways of improving the World-wide operations of Transport Command have come from the Air Transport Systems Working Party controlled by the Anglo-Canadian-American Air-Standardization Co-ordination Committee, which was formed by the U.K., the U.S. and Canadian Governments in 1948. The task of this Working Party is the standardization of the military air transport operations of the three air forces. In particular, the standardization of auxiliary equipment both for actual flying commitments and the servicing and maintenance of transport aircraft.

De Havilland Comet 2s of No. 216 Squadron at R.A.F. Lyneham, which form the high-speed element of the Command's long-range force. A total of 10 Comets are in service with the R.A.F.

Photograph copyright "The Aeroplane"

The R.A.F. Today . . . .

Flying Training Command

Air Marshal Sir Richard Atcherley, K.B.E., C.B., A.F.C., Air Officer Commanding-in-Chief, Flying Training Command.

ENTRUSTED with the task of moulding future pilots, navigators and Air Electronics Officers from the time of their entry into the Service, through initial officer training on to basic and advanced aircrew training up to "wings" standard, Flying Training Command plays an important part in producing the high standard of operational flying in the R.A.F. The Command also operates the R.A.F. College, Cranwell, the R.A.F. Flying College at Manby, and the Central Navigation and Control School at Shawbury, and, of course, the heart of flying training, the Central Flying School at Little Rissington.

To meet this requirement the Command is divided into two Groups under its Headquarters at Reading. The first, No. 23 Group based at Leighton Buzzard, is responsible for all pilot training and for pilot refresher courses. The other Group—No. 25—with its headquarters at Manby, controls the training of all navigators, air signallers, Air Electronics Officers, air traffic control officers and, in addition, operates No. 1 Initial Training School at South Cerney.

Apart from the majority of permanent-commission R.A.F. general duties officers who enter the Service through Cranwell, and the smaller number from the University Air Squadrons, all future aircrew are first posted to No. 1 I.T.S. for three months' initial training before receiving a commission as an acting pilot officer. At South Cerney the cadets complete an all-round syllabus which includes leadership and officer qualities, as well as drill and academic study.

From the I.T.S. pilots go to No. 2 Flying Training School, Syerston, or No. 3 F.T.S. at Feltwell, or No. 6 F.T.S. at Ternhill, or No. 4 F.T.S. at Worksop, for 120 hours' basic training on Provosts. In addition, a small number have been instructed on the Jet Provost, but this all-through jet training is still very limited and the intended conversion on to this method of instruction, employing Jet Provosts and Vampires, is planned when the Command starts receiving the production Jet Provost Mk. 3s at the end of this year.

On the successful completion of the 36-week Provost course, pilot cadets are transferred to an Advanced Flying Training School—No. 5 at Oakington or No. 8 at Swinderby—for a further 110 hours' instruction up to "wings" standard, when they are posted to an Operational Conversion Unit. At the A.F.T.S.s dual training is given in Vampire T.11s and solo flying is made in Vampire 5s or 9s. One exception to this two-station system of pilot instruction is the Naval Flying Training School at R.A.F. Linton-on-Ouse, where an all-through (basic and advanced) training programme, using both Provosts and Vampires, is in operation.

Navigator cadets from the I.T.S. are transferred either to No. 1 Air Navigation School at R.A.F. Topcliffe or No. 2 A.N.S. at R.A.F. Thorney Island, for a 49-week all-through course which includes approximately 200 hours' flying. At Topcliffe this is done in Marathons, Valettas and Vampire T.11s (for jet experience), and at Thorney Island in Valettas, Varsitys and Vampires. The 20-week course for training radio observers as N.C.O. all-weather fighter AI operators at Topcliffe has been suspended for the present.

Air Electronics Officers go from the I.T.S. to the Air Electronics School at R.A.F. Hullavington where they complete a one-year training course before going on to an Operational Conversion Unit. In addition to the full A.E.O. course, a 20-week advanced signallers course for N.C.O.s is run at Hullavington to provide experienced air signallers with advanced trade training and the possible selection for a commission as A.E.O.s.

Technical Training Command

Air Marshal A. W. B. McDonald, K.C.B., A.F.C., Air Officer Commanding-in-Chief, Technical Training Command.

RESPONSIBLE for the training of all Service personnel with the exception of aircrew and cadets at the R.A.F. College, Cranwell, Technical Training Command is one of the largest of the R.A.F. commands, and with the proposed "all-regular" Air Force of the future it will play an increasingly important part in the technical and operational efficiency of the R.A.F. Comprising three groups—Nos. 22, 24 and 27, of which Nos. 24 and 27 are to be merged in the near future—and the R.A.F. Technical College at Henlow and Debden, the Command has its headquarters at Brampton, Huntingdon.

Recruit and administrative trade training is the main task of No. 22 Group, with its Headquarters at Market Drayton. In addition to controlling No. 2 Reception Unit, Cardington, and a number of Schools of Recruit Training, this group is responsible for No. 2 School of Administrative Trades, for airmen clerks and suppliers, and the Administration Apprentice School at R.A.F. Hereford. It also operates the School of Administration for equipment and accounts officers and the Officer Advanced Training School at Bircham Newton, the Officer Cadet Training Unit at Jurby, Isle of Man, the Ground Officers' Selection Centre, R.A.F. Uxbridge, and the W.R.A.F. Depôt at Hawkinge.

Technical training is the province of No. 24 Group, Spitalgate, which controls No. 1 School of Technical Training, Halton (aircraft apprentices), and the boy entrant training establishments at Cosford and St. Athan. Other schools at Weeton, Kirkham, Melksham and Spitalgate, covering the engine, M.T.,

The Hunting Percival Provost and the De Havilland Vampire T.11, which are employed in the basic and advanced stages of pilot training by Flying Training Command.

Maintenance Command tradesmen working on a Hunter wing at No. 32 M.U. at R.A.F. St. Athan.

airframe, armament, instrument and electrical trade groups, and instruction in fire-fighting and rescue, photography and cookery, are also the responsibility of No. 24 Group.

Based at Cherhill, No. 27 Group includes No. 1 Radio School for aircraft apprentices and airmen in ground radio and radar trades at Locking, No. 2 Radio School at Yatesbury for air wireless and radar instruction, and No. 3 Radio School for the telegraphist trades at Compton Basset. In addition the Group controls R.A.F. Catterick, including the R.A.F. Regiment Depôt, and the R.A.F. Police Force Depôt at Netheravon. The Technical College, Henlow, is established on lines similar to Cranwell for the training of technical cadets, and also undertakes the training of specialist officers in the fields of guided weapons, aircraft and, at Debden, radar and electronics.

Maintenance Command

Air Marshal Sir Richard B. Jordan, K.C.B. D.F.C., Air Officer Commanding-in-Chief, Maintenance Command.

PLAYING a major part in keeping the operational commands of the R.A.F. at home and abroad in a high state of efficiency, Maintenance Command is responsible for receiving, storing and issuing every item of equipment, from the aircraft and other industries, that the Service uses. From its headquarters at Amport the Command controls the modification and preparation for issue of complete aircraft and other equipment, and provides major technical assistance to other formations of the Service which cannot deal with the work themselves.

Divided into No. 40 Group at Bicester, and No. 41 Group with its Headquarters at Andover, Maintenance Command includes large workshop and repair facilities and undertakes a very wide range of tasks from the repair of electronic equipment to the salvage of crashed aircraft. The work is broken down and made the responsibility of one or other of the two Groups.

No. 40 Group operates the aircraft equipment depôts, ammunition depôts, and the M.T. storage units together with the aviation fuel dumps up and down the country and the Bomb Disposal Unit at Morton Hall. No. 41 Group, on the other hand, covers the repair and salvage units; No. 238 Maintenance Unit at Calshot, the marine craft repair and storage base, and the airborne radio servicing units. The last-named also functionally controls the R.A.F. Airfield Construction Depôt at Wellesbourne Mountford.

Home Command

Air Marshal Sir Douglas Macfadyen, K.C.B., C.B.E., Air Officer Commanding-in-Chief, Home Command.

COMPRISING two Groups—No. 64 (Northern) at Rufforth and No. 61 (Southern) at Kenley—Home Command is organized on a geographical, as opposed to a functional basis. Its main task is the overall control of the 17 University Air Squadrons, the Air Training Corps and the R.A.F. elements of the Schools Combined Cadet Force contingents.

In addition to these pre-Service units, the Command administratively controls the R.A.F. Staff College, Bracknell, the R.A.F. Records Office at Innsworth, R.A.F. hospitals, and many other units in the United Kingdom and abroad. It also looks after the large number of Recruiting Centres up and down the country and is responsible for the direct implementation of Air Ministry recruiting policy.

At its Headquarters at White Waltham, Kenley and Rufforth, the Command operates communications flights which are equipped with D.H. Devons and other types. Also on the flying side of the picture is the flying scholarship scheme for A.T.C. and C.C.F. cadets controlled by Home Command, which, since its start in 1950, has awarded some 2,000 grants for pilot training on light aircraft.

The A.T.C. (which comprises some 750 squadrons organized into approximately 50 wings), and the R.A.F. sections of the C.C.F. are making large contributions towards regular R.A.F. recruiting, and a number of improvements, including more flying and gliding, are to be introduced in the near future. Fifty Chipmunks are to replace the 10 Ansons at present established for cadet air-experience flights at week-ends and at summer camps, and a second full-time gliding centre at Spitalgate, in addition to the existing centre at R.A.F. Hawkinge, is being considered. Six week-end gliding schools are to be added to the 20 already in existence.

One of the main tasks of Home Command is the control of the University Air Squadrons. Right, members of the University of Liverpool Air Squadron on their way at summer camp last year.

Photograph copyright "The Aeroplane"

The R.A.F Today . . . .

Middle East Air Force

Air Marshal Sir Hubert L. Patch K.C.B., C.B.E., Commander-in-Chief, Middle East Air Force.

FROM April 1, exactly 40 years from the date of formation of the Royal Air Force, there will be a major change in the Command structure of its units in the Middle East, and M.E.A.F. will split into two military structures. The present British Forces, Arabian Peninsula, Command with H.Q. in Aden, will become entirely independent, and will be a fully integrated joint Services organization, while retaining as its R.A.F. Commander, Air Vice-Marshal M. L. Heath, C.B.E., O.B.E., with Brig. W. M. Hutton, D.S.O., M.C., and Air Cdre. E. M. Donaldson, C.B.E., D.S.O., A.F.C., as his respective Army and Air Chiefs of Staff. On the same date, Air H.Q. Levant will be dissolved, and the R.A.F. units based in Cyprus will be directly administered by H.Q. Middle East Air Force, whose C.-in-C. will remain Air Marshal Sir Hubert L. Patch, K.C.B., C.B.E.

Unlike Aden, the Cyprus H.Q. will not be fully integrated on a joint-Services basis, having a separate C.-in-C. Middle East Land Forces, but it will be similarly responsible directly to London. A third R.A.F. component, which has been a separate Command for some considerable time, is Air H.Q., Malta (Air Marshal C. E. Chilton, C.B., C.B.E.), and this will continue its former rôle, allied with NATO.

Despite these organizational changes, which are the result of the geographical and political isolation of the remaining British centres of interest in the Middle East, the rôles of R.A.F. units in the theatre remain unchanged. Their tasks include the maintenance of internal security in British colonies and protected territories, the safeguarding of air and sea communications passing through the area, and the support of defence treaties to which Britain is allied.

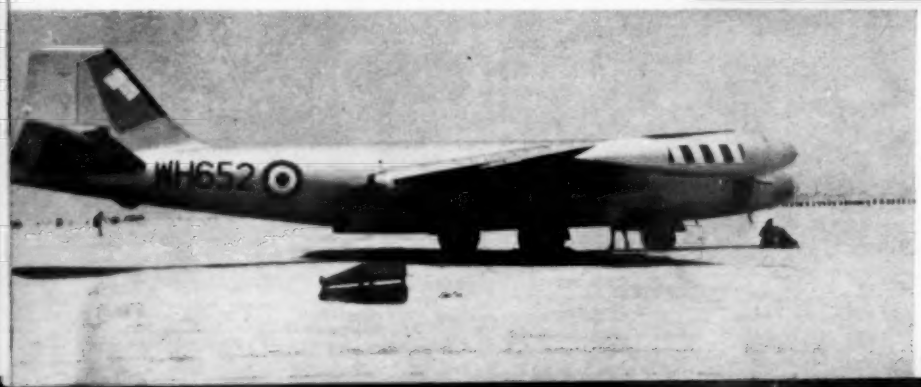
While the R.A.F. in the Middle East is like other overseas units in depending to a large extent on strategic reinforcement plans, which were demonstrated so effectively during the Suez operations, for its maximum strength, it also deploys adequate forces for immediate requirements. With the loss of numerous bases in the Middle East over the past few years, these forces are smaller in overall quantity than before, but they are well equipped and finely balanced for their commitments.

In Aden, for example, which is not an air command, although currently headed by an R.A.F. Commander, a "fire-brigade" force has been carefully assembled with a variety of aircraft equipment for colonial policing operations in the Arabian Peninsula. Tribal disturbances in the West Aden Protectorate and in Oman have been continuing intermittently for many years, the former area being particularly troubled by invading Yemenis and, despite considerable differences in terrain and climate, R.A.F. operations in support of ground forces are generally similar to those in Malaya.

The prevailing heat and humidity are much the same in both cases, but desert replaces jungle in Aden, and the soft contours of Malaya are absent in the wild and barren 8,000-ft. granite crags of the Western Protectorate escarpment. For offensive action against tribesmen in proscribed areas, or to assist troop or police convoys under attack, the de Havilland Venom FB4s of No. 8 Squadron are based, with the other air elements, at the main R.A.F. airfield in Aden, of Khormaksar. No. 8 Squadron has now been associated with Aden for exactly 30 of the R.A.F.'s 40 years, and has built up a unique record of achievement under very difficult conditions.

Its aircraft are equipped with 20-mm. cannon, rocket-projectiles or bombs, and their manœuvrability and good endurance at low altitude have proved invaluable for winkling out pinpoint targets in the precipitous valleys of the area. Also in No. 8 Squadron at the moment are four Meteor FR.9s formerly from No. 208 Squadron, Cyprus, and these have been found equally useful for reconnaissance and offensive operations. They

Above, cockpit temperatures reach almost unbelievable heights in Aden, where the Venom FB4s of No. 8 Sqn. are fitted with sunshades while at dispersal on Khormaksar airfield.



Above, a Pembroke of the Aden Communications Flight is seen on the stony airstrip at Dhala, in the Western Protectorate, with a radio-equipped contact car for air liaison. Left, four former Venom squadrons are now equipped with Canberras at Akrotiri, Cyprus, and this aircraft still bears the fighter markings of No. 32 Sqn.

retain the four 20-mm. cannon armament of the standard Meteor, but also carry oblique and forward-facing cameras for supplying target information to the ground forces.

Backing up the tactical offensive in Aden are the Shackleton 1s and 2s of No. 37 Squadron, which is permanently based at Khormaksar, having replaced visiting Coastal Command squadrons and the old Lincolns formerly used for a similar job. The Shackletons have a most useful versatility for duties in Aden, which include, in addition to their maritime rôle, patrolling ground convoys, providing air links, undertaking long-range reconnaissance and offering both strafing and bombing capabilities. There appears to be quite a long-term requirement for these hard-working piston-engined aircraft.

Equally industrious is the R.A.F. air transport element in Aden, which greatly increases the mobility of the ground forces, and enables many otherwise impossible operations to be performed. Every Government guard fort in the two Protectorates has an air strip of sorts, as road transport is usually out of the question, and these stony landing grounds, roughly levelled from the surrounding rock, are used by the Valettas and

Intensive operations against the EOKA terrorists in Cyprus have been conducted with the assistance of the Bristol Sycamore HR 14 helicopters of No. 284 Sqn., from Nicosia, mainly in the forest-clad Troodos mountains.

Pembrokes of No. 84 Squadron, and the Pioneers of No. 78 Squadron. Blackburn Beverleys from the Abingdon squadrons have also been operating with distinction in Aden on rotational detachments of nine months, and among the substantial loads which they have proved capable of carrying have been armoured cars and other M.T., thereby conferring a great advantage in mobility to the ground element. The success of the Beverley may be measured by the fact that the type is progressively to replace the Valettas of No. 84 Squadron.

There are five strips in the Western Protectorate at Dhala, Kataba, Mukeiras, Beihan and Ataq which are sufficiently large to be used by the transport force of Valettas and Pembrokes, but, with the arrival of the Pioneers, numerous other areas were opened up in the Protectorates. There is an obvious requirement for a medium-sized helicopter in Aden. Three Bristol Sycamores are maintained there for search and rescue duties, but it is difficult to find a larger production type with sufficient performance to cope with the combination of high temperatures and altitudes.

The Pioneers have proved partly the answer, with the assistance of the Pembrokes on the slightly bigger strips, but an economical solution has been promised by the end of 1958, with the introduction at Khormaksar of the first Twin Pioneers, which should be able to accomplish almost as much as a helicopter, and more under some conditions.

They will be used for rapid troop movements within the area, and for re-supply of the forts. Suitable strips for their use also exist in British Somaliland, which is another responsibility of the Arabian Peninsular Command, and their cruising speed is sufficiently high, compared with helicopters, to make them a thoroughly practical proposition for reinforcement flights, with the Valettas, Beverleys and Pembrokes, along the coast of Southern Arabia, to Riyan, Salala, Masira and Sharja, as well as to the most westerly outpost, at Eastleigh, Nairobi. No R.A.F. squadrons are based in East Africa, but Eastleigh serves as a staging post and maintenance unit, and can be rapidly reinforced if necessary.

Another component of British Forces, Arabian Peninsula, is in the Persian Gulf, at Bahrain, where the senior R.A.F.

A visiting Valiant on a strategic reinforcement flight casts a purposeful shadow on the very large runway during take-off from Akrotiri, Cyprus.

officer at the joint H.Q. is Gp. Capt. H. E. Bufton, D.S.O., O.B.E. Bahrain is very important as a staging post on the Far East trunk route, and also serves as a base for operations, when required, in Trucial Oman. Normally, the only aircraft operating from Bahrain are the Pembrokes of No. 1417 Flight, which are employed on communications and reconnaissance duties, and operate to Sharja and elsewhere but, in addition to Transport Command Hastings and Comets, the airfield is also used by Valiants and Canberras on " Lone Ranger " flights.

As the northern element of the R.A.F. in the Middle East, H.Q. M.E.A.F. looks after units in Cyprus, North Africa and Iraq, and is mainly concerned with the British commitments to the Baghdad Pact. It is also adjacent to the southernmost fringes of N.A.T.O., and, as the only British base on sovereign territory in the area, Cyprus is of great strategic importance. The Combined Services H.Q., although not fully integrated, is located at Episkopi, on the island, with the very large military airfield of Akrotiri nearby.

With a 9,000-ft. by 200-ft. runway, and hardstandings designed to accommodate Valiants, Akrotiri houses the main operational element of M.E.A.F., comprising at the moment five squadrons of Canberras, while the joint-user airfield of Nicosia accommodates the R.A.F. transport and fighter squadrons. Akrotiri was built to replace some of the bases in the Canal Zone, and it is ironical that its first operational use, within a few days of the runway completion, was as a base for British and French squadrons in the Suez campaign, for attacks against the former R.A.F. airfields in Egypt. Having been started in 1954, the airfield, on the southern extremity of Cyprus, is still not fully completed and work will continue for many more months on its buildings.

The Canberra bomber wing at Akrotiri comprises Nos. 6, 32, 73 and 249 Squadrons, all of which were equipped until recent years with Venom fighter-bombers in Iraq, Jordan and Cyprus. The Venoms have now been completely replaced by Canberra bombers, which are well suited for tactical operations in the Middle East, and provide a substantial striking force for the R.A.F. in that area. The Canberras frequently exercise with neighbouring countries in the N.A.T.O. and Baghdad alliances, and are supported by the photographic-reconnaissance operations of the fifth Canberra unit, No. 13 Squadron, also based at Akrotiri.

No. 13 Squadron formerly operated Meteor PR.10s in the Canal Zone, and with these aircraft, it was the first unit to move into Akrotiri. It has since re-equipped with Canberra PR.7s, and continues its duties with increased effectiveness, ranging far over the Mediterranean and Middle East. In passing it may be mentioned that the Canberra bomber squadrons do much of their operational training on a bombing range at El Adem, in Cyrenaica, which marks the most westerly outpost of M.E.A.F., and is also an important staging post.

Internal security is a difficult problem in Cyprus, and, as in other parts of the World, the R.A.F. is called upon to assist in its maintenance. The principal air force contribution is by

Various activities of the R.A.F. in Malta are well illustrated by this mixed formation over the stone-walled island. All the aircraft are Rolls-Royce powered and comprise a Meteor NF 13 of No. 39 Sqn.; a Shackleton MR 2 of No. 38 Sqn.; a Conway-Vulcan; a Valiant BK.1 of No. 90 Sqn.; and a Canberra B.6 of No. 12 Sqn. The latter three aircraft are visitors on trials or training flights.

the Sycamore helicopters of No. 284 Squadron, based at Nicosia, and these have performed invaluable work against EOKA terrorists, particularly in the 6,000-ft. Troodos Mountains.

Since its establishment in 1956, with one rotorcraft, the Squadron has expanded to a strength of more than a dozen Sycamores, and has been actively employed on troop lifting, reconnaissance and casualty-evacuation duties. On several occasions the helicopters have enabled platoons of troops and police to surprise terrorists in their hide-outs by the "vertical envelopment" technique, and they are able to warn transport convoys in advance of possible ambushes or road obstructions.

Although Nicosia was the main base for the Meteor FR.9s of No. 208 Squadron, R.A.F., for some time, fighter defence has largely been in the hands of detachments of Hunters from the U.K. The most recent representatives of Fighter Command were the Hunter 6s of No. 92 Squadron, but No. 208 Squadron has just re-formed with similar aircraft, as the resident air defence unit.

In accordance with the policy for contracting Fighter Command, No. 34 Squadron at Tangmere has taken over the designation of No. 208 Squadron, and moved out to Nicosia, where the Meteor FR.9 unit has been disbanded. This enables a rapid change-over to be made, while preserving the traditions of the older squadron and without the necessity for conversion training for air and ground crews. Rapid reinforcement is also greatly facilitated if aircraft of a similar type are already stationed at the forward base, for maintenance backing.

Completing M.E.A.F. strength at Nicosia are the Hastings of No. 70 Squadron, which is the surviving unit of the former Middle East Transport Wing, and re-equipped from Valettas early in 1956. Its aircraft operate all round the Middle East, although their task is now made difficult by the loss of over-flying rights in most of the countries surrounding Cyprus. Only the northern route, over Turkey, is now open, for both trunk and internal-Command services, and this involves a substantial detour around Syria, and down the Tigris valley over Iraq. Long-range aircraft fly on this route from Cyprus or El Adem to Bahrain, but for the shorter-legged types Habbaniyah, in Iraq, is available for staging purposes.

This former R.A.F. base, now manned by the Royal Iraqi Air Force, has a small British liaison party and a station flight with a couple of Pembrokes, under the Senior British Officer, Iraq, Gp. Capt. H. I. Edwards, V.C., D.S.O., O.B.E., D.F.C., who is responsible to H.Q. M.E.A.F. Under the Baghdad Pact, the R.A.F. is assisting the Iraqi forces, including R.I.A.F. conversion to Hunters, and aircraft from M.E.A.F. squadrons visit Habbaniyah from time to time. Meteor 8s are also provided to tow targets for the Iraqi fighter squadrons.

At the other end of the Mediterranean from Cyprus, Air H.Q. Malta is an autonomous Command, whose C.-in-C., Air Marshal C. E. Chilton, C.B., C.B.E., is also Air Deputy to CINCAFMED, in the NATO organization. In the event of a war, his maritime forces would come under the orders of SACEUR, and already participate in wide-scale joint NATO exercises. Their main strength is represented by the Shackletons of No. 38 Squadron, at Luqa, Malta, which also houses the Meteor 13s of No. 39 Squadron.

The only R.A.F. unit to operate this tropicalized Meteor night-fighter, No. 39 Squadron has had its present aircraft since it was stationed in Kabrit, in the Canal Zone, four or five years ago, but its future is at present under discussion. At the moment, it also has a detachment of Meteors based in Cyprus. Luqa will also be used again in the near future by PR. Canberras of No. 69 Squadron, 2nd T.A.F., on training detachments, while the strategic reinforcement of Malta is extensively practised by Shackletons, Valiants and Canberras of Coastal and Bomber Commands. Apart from its operational uses illustrated by the Suez campaign, Luqa is also a staging post.

One other airfield is used by the R.A.F. in Malta, at Takali, which is the base for a communications and target-towing squadron, equipped with a variety of aircraft, including Pembrokes, Valettas, Meteor 8s, and some Beaufighters.

A final component of A.H.Q. Malta, and of the R.A.F. in the Middle East, is the staging post maintained at the Libyan airfield of Idris, near Tripoli. The Ministry of Supply Tropical Experimental Unit is also based there.

No. 208 Sqn. has just re-equipped, via No. 34 Sqn., from Meteor FR. 9s to the latest series of the Hunter 6, with "saw-tooth" wings and "flying tails" and, with the assistance of four long-range tanks per aircraft, has flown out to Nicosia to become the resident fighter squadron.

The R.A.F. Today . . . .

Far East Air Force

Air Marshal the Earl of Bandon, K.B.E., C.B., C.V.O., D.S.O., Commander-in-Chief, Far East Air Force.

IN COMMON with the other overseas components of the R.A.F., Far East Air Force has been contracting slightly over the past few years, and its aircraft strength has been progressively reduced, but it is unique in being the only Command continuously engaged on active air operations. These, too, are running down in scale, with the tapering off of the Emergency in Malaya, and the emphasis has shifted from fighter and bomber strikes, to an all-out air supply campaign, but this is of primary and continuing importance and it can safely be said that police action against the jungle terrorists would be impossible without its aid.

Apart from the air operations in Malaya, the Royal Air Force in the Far East is confronted with numerous political problems presented by the newly gained independence of many of the countries in its area, which remains quite extensive. At the moment, F.E.A.F. controls bases in Hong Kong, North Borneo, Malaya, Singapore and the Maldive Islands, and has staging rights in the Philippines, Viet-Nam and Ceylon. Since Malaya became an independent country within the Commonwealth in August, 1957, however, R.A.F. forces remain there only at the request of the local Government, and staging rights in Ceylon expire in two years.

Singapore Island, which is a Crown Colony and the Headquarters of F.E.A.F., is politically unsettled, and its future status depends to a large extent on the elections later this year. There is no doubt, however, about its importance, since in addition to the Headquarters element of the British Services in the Far East, it also houses the entire F.E.A.F. strike force and occupies a key positon on the vital strategic trunk route from Europe to Australia. The protection of this route, for the benefit of both air and sea communications, is one of the principal tasks of F.E.A.F., others being the safeguarding of British interests in the area; the contribution of operational units to S.E.A.T.O. and the Commonwealth Strategic Reserve; support for the ground forces in the Malayan jungle and training of local air units in the newly independent countries.

Present Commander-in-Chief of F.E.A.F. is Air Marshal the Earl of Bandon, K.B.E., C.B., C.V.O., D.S.O., who has his headquarters at Changi on the eastern tip of Singapore, and who took over the Command in mid-1957. During a recent visit to the Far East we were reminded that Air Marshal Bandon, as R.A.F. representative, received the Japanese surrender in Malaya in 1945 and, 12 years later, came back as C.-in-C. just in time to attend the independence formalities of that country. To his personal experience of the area is therefore added a knowledge of the political history of Malaya, which is of great value in framing defence requirements in agreement with the newly independent nations, and at staff conferences in S.E.A.T.O. H.Q. at Bangkok.

F.E.A.F. is organized on a purely tactical basis, and now has no operational elements based on its outstations. It relies a great deal on the strategic mobility concept, not only for local reinforcement to outlying stations within the Command, but also for strengthening its resources from the United Kingdom in the event of such action as a limited war. It has already been shown how rapidly the V-bomber force may be deployed overseas in an emergency, and the arrival of Valiants, Vulcans or Victors would promptly give F.E.A.F. strategic nuclear capability.

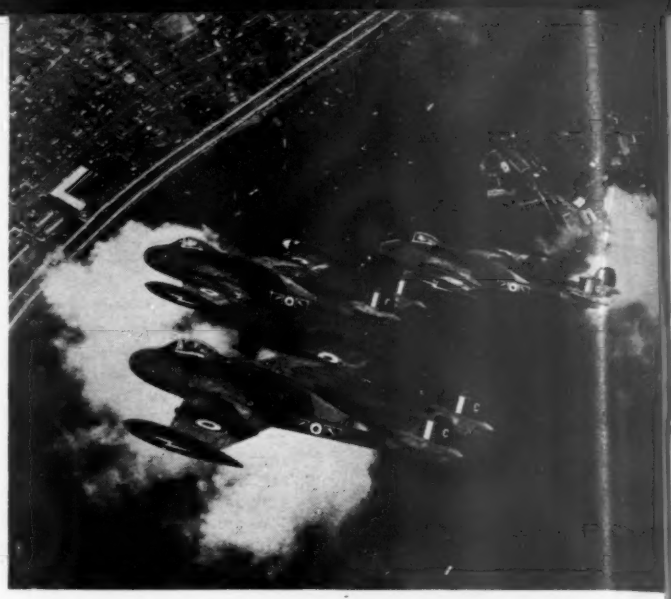
Far East Air Force is one of the most outstanding examples of Commonwealth co-operation, including as it does units from the R.A.F., R.A.A.F., R.N.Z.A.F. and the Malayan Air Force within its organization. With the diminishing R.A.F. commitment in Malaya will come a corresponding increase, this year, in Commonwealth participation, principally from Australia, and the R.A.A.F. will introduce the first swept-wing aircraft into the area, in the transonic shape of the Avon-Sabre, as well as additional Canberras.

Future plans for F.E.A.F. are dictated by economic as well as political measures, and one of the first results of these will be the withdrawal of R.A.F. units from Hong Kong, except for staging purposes. There can no longer be any real military justification for basing a squadron at Hong Kong, and No. 28 Squadron is being reduced to a token unit, with a handful of Venoms and a Vampire Trainer. At the same time, one of the Singapore Venom units is being reduced in establishment, so that the net saving is one complete fighter squadron. Hong Kong has two Bristol Sycamore helicopters for search and rescue duties, and a target-towing flight with some Beaufighters, but by the end of 1958, the R.A.F. will be represented mainly by visiting Canberras from Malaya.

Another economy is the replacement of two Valetta squadrons in the Far East Transport Wing by one squadron of Hastings, which are able to fly non-stop to Hong Kong from Singapore. Nevertheless, the airfield at Labuan, in North Borneo, will be retained as a diversion, and for use by short

Kuala Lumpur is the main base for jungle support operations in Malaya, and a selection of some of the aircraft used on these sorties is shown here. Types include the sky-shouting Dakotas and Austers of No. 267 Sqn.; the Whirlwinds of No. 155 Sqn.; the Valettas and an R.N.Z.A.F. Freighter of the Air Supply Force; and, in the far distance, the Sycamores of No. 194 Sqn.

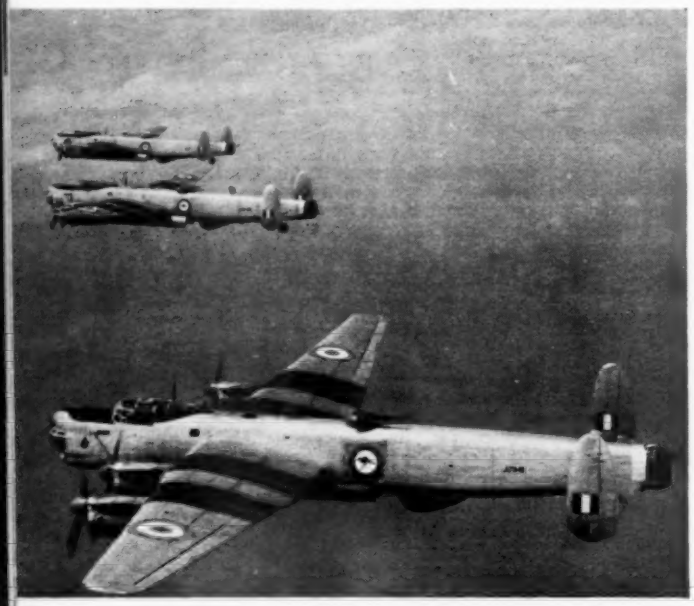
Photograph copyright "The Aeroplane"



Seen over the Singapore waterfront, the Venom FB 4s of No. 60 Sqn., at Tengah, are responsible with No. 14 Sqn., R.N.Z.A.F., for the air defence of the city and the support of army and police units in the jungle.

range aircraft, while other staging posts in the vicinity available for R.A.F. use are Clark Field, on Luzon, and Saigon, in Viet-Nam. Labuan has also been extensively used by the last R.A.F. Sunderlands, which are based in Singapore, but these are finally to be replaced by Shackletons, on the grounds of economy and efficiency, and flying-boats will vanish, not unlamented, from the R.A.F. Their disappearance in a few weeks time, and the introduction of helicopters for search and rescue duties, will also seal the fate of most of the R.A.F.'s marine craft, again with corresponding economy.

In Ceylon, the staging post at Katunayake, through which we had flown on No. 216 Squadron's 2½-day service from Lyneham to Singapore, will eventually be transferred to the new R.A.F. base at Gan, on Addu Atoll, in the Maldives, together with a radio station. Gan airstrip has been under construction for some considerable time, and is interesting in that it will occupy precisely the whole 8,500-ft. length of the island. Some of the initial personnel and equipment to build the airfield were flown in by Sunderland, but a rough strip was then hacked out, and there is now a regular Valetta service between Gan and Ceylon. The strip should be fully operational within the next two years.



Shortly to return to Australia after more than seven years in Malaya, the Lincoln B.30s of No. 1 Sqn., R.A.A.F., have economically combined bombing and ground strafing roles against Communist terrorists.

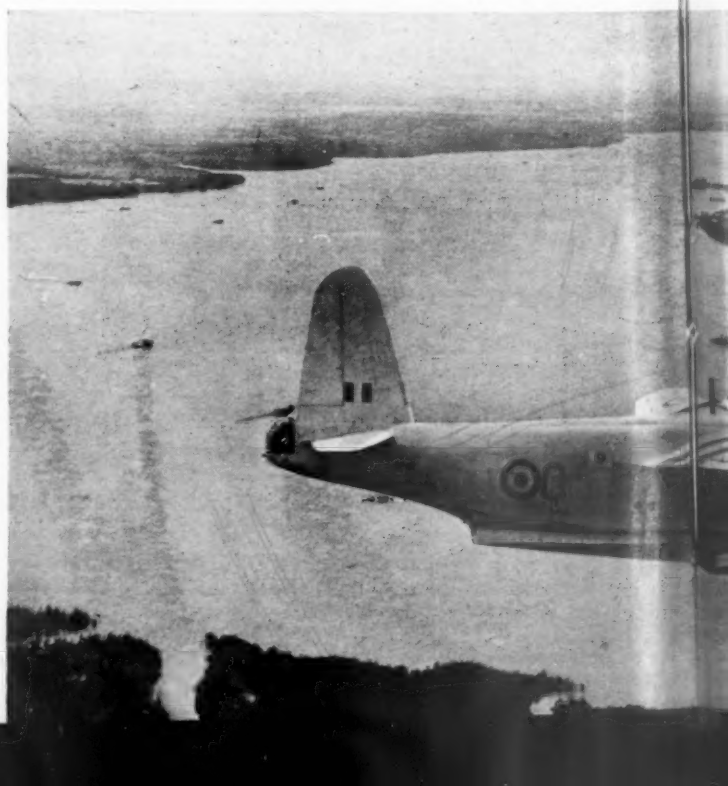
Strength in Singapore

Singapore is little bigger than the Isle of Wight, but with rather more people—over 1,000,000, in fact—and containing four military air bases, as well as a new and large civil airfield. Its air is therefore somewhat crowded, and there is a complex airways system, but no real operating problem, despite the limitations on military aircraft movements, which outnumber civil flights by about 14 : 1. The military airfields have clearly defined functions. Changi, on the eastern tip, is primarily a transport base; Seletar, in the north, is mainly a maintenance unit, and also a flying-boat base; Sembawang, in the centre, is a combined Services and light-aircraft base; and Tengah, in the North-West, is the centre for strike operations.

At Changi, which is the terminal of the Far East trunk route, commanded by Gp. Capt. I. C. K. Swales, are based the Valettas of No. 52 Squadron (Sqn. Ldr. D. G. F. Palmer) and the Hastings of No. 48 Squadron (Sqn. Ldr. L. Hague). With a detachment of three or four Bristol Freighters of No. 41 Squadron, R.N.Z.A.F., these provide crews and aircraft for the Air Supply Force, Far East, which operates from Kuala Lumpur on jungle support sorties, and also fulfil the normal transport commitment within the Command. No. 48 Squadron completed its conversion from Valettas in August, 1957, the other Valetta squadron (No. 110) in the Wing having been disbanded.

During our visit to F.E.A.F., in late January, the first Blackburn Beverley to appear in the Far East was flown out from Abingdon to Changi by its crew from No. 47 Squadron, and stayed for several weeks to conduct freighting and parachuting trials, including dropping heavy loads in the Federation. The parachuting of supplies and troops is undertaken on a large scale in Malaya, and at Changi there is an R.A.F. Parachute Training School, under the command of Sqn. Ldr. R. Mullins. In the training hangar of the school Commonwealth troops receive a ground instructional course, before completing eight jumps from Valettas to qualify as paratroops. A grass area on the airfield at Seletar is used as a dropping zone.

Another interesting training establishment at Changi is the Jungle Survival School (Flt. Lt. Gant, D.F.M.), where all ranks of all Services who fly over Malaya are taught how to be self-sufficient if forced to land in the forbidding forests of the Federation. The main purpose of the school is to instil confidence in personnel who may find themselves alone in an apparently hostile jungle, where 1,000 yd. a day is exceptionally good progress. To assist in this aim, each course spends 4½ days, travelling in pairs, in primary jungle, after six days of instruction at Changi. During the spell in the jungle the trainees sleep alone each night, separated from each other by at least 100 yd., and this experience is of the greatest value in mastering the psychological fear which is the greatest factor in preventing jungle survival.



Another flying element at Changi is a detachment of a few Canberra P.R.7s from No. 58 Squadron, Bomber Command, at Wyton, which is now the sole unit in this command with this mark of aircraft. This detachment to the Far East for photo-survey work is a regular twice-yearly commitment for the squadron, and is another example of the strategic reinforcement system which is extensively practised throughout the R.A.F.

One of the most pleasant stations in Singapore, Seletar is built on the edge of the Straits of Johore, and a golf course has been made on one side of its verdant grass area. This station (Gp. Capt. D. D. Rogers) is also one of the most interesting, with a remarkable variety of flying activity, ranging from jets to flying-boats. It is also the biggest station in F.E.A.F., in terms of population, which with the natives and civilians in its area, amounts to some 10,000 people, and, finally, it is the biggest Maintenance Unit in the R.A.F.

From its Wing Commander Flying, Wg. Cdr. J. L. Kerr, we heard something of the problems and activities of the various units, against a background noise, as we sat in his office, of Meteors, Whirlwinds, Pembrokes, Pioneers, Valettas and Devons going about their lawful business. As an M.U., with Engineering and Supply Wings in addition to the normal Flying, Technical and Administrative elements, Seletar sees nearly every type of aircraft in service with F.E.A.F., or about 16 different machines in all, excluding various marks, plus 11 different powerplants. It is also at the end of a long pipeline from the U.K., so that the spares problem for major overhauls can become quite formidable.

Another slight difficulty is the length of the single runway, which at 1,640 yd. is marginal for several of the aircraft having to use it, including the Meteors of a resident squadron. Fortunately the take-off problem is eased by the absence of obstructions at the seaward end of the runway, but for landing, braking is complicated by the fact that the entire centre portion of the strip is surfaced with slippery PSP (pierced-steel planking).

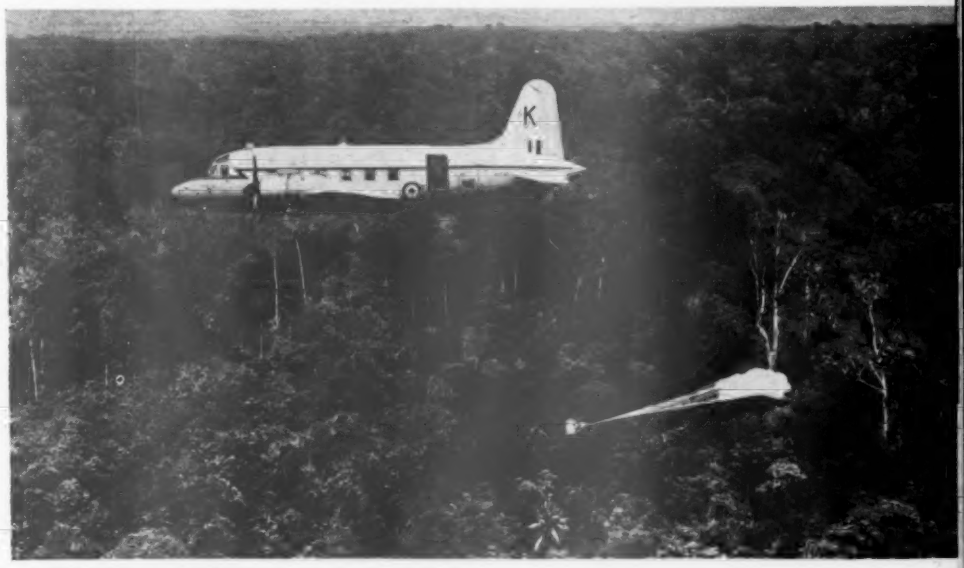
No. 81 Squadron (Sqn. Ldr. R. J. Lindford) operates Meteor PR.10s from Seletar, on daily sorties to provide systematic photographic coverage of Malaya for the Army, and also uses a few Pembrokes for reconnaissance duties at lower altitudes. The Meteors operate at about 23,000 ft. to produce photographs of the required scale, and as many target areas are as far north as near the Thai border, their sortie time is frequently more than 2 hr. They therefore require a heavy fuel load, with external ventral and wing tanks, and must use one-third flap to take-off safely from Seletar's runway.

Photographic reconnaissance, as always, plays a very important part in the Malayan campaign, and daily coverage of jungle areas enables movements, camp sites or efforts at cultivation by Communist terrorists, or C.T.s as they are known to the Service, to be instantly observed. The reconnaissance force also includes the Bomber Command Canberras, and the Auster 9s of No. 656 Squadron, Army Air Corps, and its activities are an invariable prelude to offensive action.

Unlike the P.R. Meteor's compact nose and rear fuselage installation of vertical, oblique and forward-facing cameras, the reconnaissance Pembrokes have their photographic equipment mounted in the spacious cabin, with special windows of optically flat glass. They have proved less useful than the Meteors for P.R. duty because of their ceiling limitation in Malaya of about 14,000 ft., and will probably be withdrawn from this task. The Meteors are also due for replacement, and will probably be succeeded by Canberra PR.7s later this year.

There can be few people in the R.A.F. who do not feel a pang at the impending doom of the last Sunderlands, in No. 205/209 Squadron (Sqn. Ldr. J. W. Moffat) at Seletar, but it is impossible to make a further economic case for these 20-year-old veterans, and they will be replaced by Shackletons during the next few months. The Sunderland has maintained its unique record of being in first-line operational service throughout the entire two decades of its career with the R.A.F., to the very end, and the boats of No. 205/209 Squadron still harass the jungle terrorists with bombing attacks, in addition to performing air-sea rescue and coastal reconnaissance duties.

In keeping with its pre-atomic conception, the Sunderland carries vast quantities of 20-lb. fragmentation bombs stacked in the galley, which are armed and thrown overboard by hand while the aircraft cruises over specific jungle areas throughout the night, on sorties of up to nine hours' duration. This nuisance-bombing is not at all appreciated by the C.T.s, who are effectively kept on the move without rest, and driven towards army or police patrols. The only real limitation of the Sunderland for this sort of job is its ceiling of about



Right, Valettas of the Air Supply Force, Far East, are not often blessed with such an open dropping zone as this when supplying food and other stores to troops and police in the Malayan jungle. In many cases the clearings are in inaccessible valleys, the mountains of which are often in cloud.

Below, flying over the Straits of Johore is one of the last three Sunderlands in the R.A.F., which are soon to be replaced by Shackletons in No. 205/209 Sqn., based at present at Seletar. The Sunderland's unbroken operational service of about 20 years is unlikely to be challenged by any other aircraft.

Photographs copyright "The Aeroplane"

Excellent work is being done by the Scottish Aviation Pioneers of No. 267 Squadron, F.E.A.F., in supplying jungle forts in Malaya, and flying into tiny strips in the Cameron Highlands, seen here in the background.

Photograph copyright "The Aeroplane"

8,000 ft., which prevents it operating in the more mountainous parts of Malaya. In the Far East, the gross weight of the Sunderland is restricted to 61,000 lb., compared with the 62,500 lb. which was the U.K. limit, and the maximum landing weight is 57,000 lb.

Another useful job still performed by the Sunderlands is a monthly anti-piracy patrol off the eastern coast of North Borneo, where suspicious native shipping is intercepted and reported, and generally discouraged. Other jobs done by the boats include search and rescue (one Sunderland is always on standby, to take-off in 1 hr. by day, and in 2 hr. by night) at Seletar, and Hong Kong, where one aircraft is detached; and occasional transport sorties. Sunderlands initially maintained Gan airstrip completely for the first five months of its construction, until September, 1957, with food, supplies and equipment, and there is a suggestion that a couple of flying-boats should be retained for use by the Prime Minister of the Maldive Islands, to enable him to tour his flock.

As all the R.A.F. flying-boat facilities are being rapidly withdrawn, this scheme will probably not materialize and, for the same reason, no more Sunderlands will return to the U.K. from the Far East. They are being sold locally in Singapore, and scrapped after being beached, and it is sad indeed to see these fine boats, still as up to date in appearance as when they first flew, being broken up at Seletar. At the time of our visit, there were seven on squadron establishment; next month, the total will be reduced to three, and these are due to be scrapped in the autumn. It is hoped that the Air Historical Branch will ensure that at least one is kept for the R.A.F. air museum. We were very fortunate at Seletar in being able to make a brief flight in one of the Sunderlands, at 130 knots over the Straits of Johore, and to handle for the last time one of the classic aircraft among the many fine types that have distinguished themselves in R.A.F. service.

When the Shackletons arrive to replace the last Sunderlands they will of necessity operate from Changi, since they can take-off and land at Seletar only at their lightest practicable weight, and they will almost certainly be followed in this move by the future Canberras of No. 81 Squadron. Completing the present veteran atmosphere at Seletar are the three Beaufighter TT.10s of the target-towing flight, which operate for the benefit of the Royal Navy. They tow sleeves behind 8-10,000-ft. cables for shipboard anti-aircraft practice, while several Meteor 8s in the flight provide targets for radar A-A fire.

Before describing Tengah, the main base for "Firedog" operations, as all sorties connected with the Emergency are designated, a brief outline of the current situation in Malaya is necessary. The Emergency was declared in June, 1948, when about 5,000 determined and fanatical terrorists began a campaign of indiscriminate violence against both Europeans and Asians in the Federation of Malaya and Singapore, and the R.A.F. was brought in at an early date to assist the army and police in the jungle.

Aircraft therefore had a secondary rôle, which was largely dictated by the difficult topography and luxuriant vegetation of Malaya, and there was no question of air control, but by systematic reconnaissance and bombing and strafing attacks, Commonwealth air forces over the past 10 years have done a great deal to drive the terrorists deeper and deeper into the jungle, and to rob them of initiative in attack. There are probably only about 1,000 terrorists left in the jungle, and with the recent political moves in Malaya it is possible that the Emergency may end this year.

Since the independence of Malaya, an Emergency Operations Council, under the chairmanship of the Federation Prime Minister, has been set up, and includes a Director of Emergency Operations, who is a British officer of the rank of Lt.-Gen. He directs the operations of both the Overseas Commonwealth and the Federation forces, but both of these remain under their respective leaders. Commonwealth forces are not employed on emergency operations when suitable Federation forces are available, nor on operations of which their national authorities may disapprove. The Commonwealth Strategic Reserve of British, Australian and New Zealand forces is afforded the right to be maintained in Malaya, in return for defence and training guarantees for the Federation.

Air supply of the troops in the jungle is now the principal rôle of the R.A.F. and Commonwealth forces in Malaya, but a strike element is still required, and is being maintained at Tengah. Now, the primary job of the strike force, which comprises eight Lincolns of No. 1 Squadron, R.A.A.F., and the 12 Venoms each of Nos. 14 Squadron, R.N.Z.A.F., and 60 Squadron, R.A.F., is to harass the enemy, with the lethal aspect of air attacks a secondary matter. Although the squadrons seldom have the satisfaction of observing concrete results from their sorties, the Army continue to place the greatest value on their effects.

Requests for air support by the Army are routed through the G-2 (Air) and then the Sqn. Ldr. (Ops.), following either intelligence or P.R. information, and strikes can be laid on at very short notice if required. In the case of harassing attacks, an area covering several map squares suspected as containing terrorists may be bombed for several days with 500-pounders at irregular intervals by three or four Lincolns. For strikes against particular targets, pattern bombing may be employed by five Lincolns, flying about 75 yd. apart, and each releasing 14 1,000-lb. bombs (costing £100 per missile). For most of the 10 years' Emergency, time-expired or war-surplus explosives have been used, but it has recently become necessary to begin using new stock.

The Lincoln has proved very useful for the war in Malaya, and although no R.A.F. squadrons are equipped with these aircraft, the Australians have been carrying on at Tengah with their No. 1 Squadron, R.A.A.F., for the past seven years, as part of the Commonwealth Strategic Reserve. Commanded by Wg. Cdr. K. V. Robertson, the Lincoln squadron is now finding it difficult to find worth-while targets, but is due to return to Australia in July to re-equip with Canberras.

During its stay in Malaya, No. 1 Squadron has economically combined the dual rôles of bombing and ground strafing, being well-equipped for the latter duty with its four 12.7-mm. Browning guns in nose and tail turrets, and two 20-mm. Hispano cannon in the Bristol dorsal turret. Its Lincolns are Australian-built B.30s, which since July, 1950, have dropped 32½ million pounds of bombs in 3,500 sorties and 21,000 flying hours over Malaya, operating at 3-4,000 ft. by day, and at 10,000 ft. (the safety height, for the 7,000-ft. Cameron Highlands) by night. In harassing attacks at night, the Lincolns fly in formation, using navigation and special lights as an aid, and radar target marking for bombing. During the day, either time-and-distance

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runs from known points or Auster target marking systems are employed for bombing.

No. 1 Squadron, which is the oldest unit in the R.A.F., is part of No. 82 (Bomber) Wing at Amberley, the other two squadrons of which are already equipped with Australian-built Canberras. One of these, No. 2 Squadron, is due to move in to Butterworth, in the north of Malaya, when that new base is completed by Australian engineers, and will in effect replace No. 1 Squadron, while the Strategic Reserve force there committed to S.E.A.T.O. will also include two R.A.A.F. Sabre squadrons. Australian interest in Malaya is already acknowledged by the fact that No. 224 Group, R.A.F., which controls all the operational elements in F.E.A.F., is commanded by Air Vice-Marshal V. E. Hancock, C.B.E., D.F.C., R.A.A.F.

The other Commonwealth unit at Tengah, No 14 Squadron, R.N.Z.A.F. (Sqn. Ldr. A. F. Tucker), operates its Venom FB.1s alongside the Venom FB.4s of No. 60 Squadron, R.A.F. (Sqn. Ldr. A. F. Jenkins) in harassing attacks with bombs, rockets and cannon against the C.T.s, but is due to be withdrawn on May 16, to re-equip with Canberra B.2s. These will be hired from the R.A.F., as are the Venoms, and four crews have been sent to the U.K. for conversion. No. 14 Squadron will continue to operate its Canberras in Malaya, as part of New Zealand's contribution to the defence of South-East Asia.

Before coming to Tengah, in May, 1955, No. 14 Squadron flew Vampires from Nicosia, Malta, alongside the R.A.F. and re-equipped with Venom 1s soon after reaching Singapore. Its present establishment is 14 Venoms and one Vampire T.11, and like No. 60 Squadron, it has a day fighter/ground attack rôle. Both marks of Venoms are employed mainly on bombing sorties, carrying two 1,000-lb. bombs on underwing racks, but are occasionally used for strafing, with rockets and cannon. No. 60 Squadron's Venom 4s have provision for additional fuel; more powerful 4,850-lb. s.t. Ghost 103 turbojets; power-boosted ailerons as well as revised tail surfaces, and are the only aircraft of their mark in the Far East. They have been with the squadron since about March, 1957, and in addition to ground-attack sorties, have been employed on interception exercises with the local fighter sector for the air defence of Singapore.

The remaining squadron at Tengah is No. 45 (Sqn. Ldr. C. C. Blount) which having been disbanded when operating Venoms at Butterworth, re-formed on November 1, 1957, at Coningsby with Canberra B.2s. The first flight of aircraft were ferried out to Malaya early in December, and the second flight left early in January. Since that time, the squadron has been busy training in the tactical rôle for operations in Malaya.

Operations Up Country

With Butterworth out of action, Kuala Lumpur is the sole operational base in the Federation of Malaya at the moment, and is an extremely busy station. It is a joint-user airfield, with the R.A.F. station commanded by Gp. Capt. P. E. Warcup, O.B.E., but military movements far outnumber those of civil aircraft, and there is constant activity in the flight areas by the side of the long airstrip.

Kuala Lumpur is the centre for all the transport support aircraft and helicopters, which alone make it possible for the Malayan police and army to maintain their chain of jungle forts, and contain the threat of widespread terrorism.

Two R.A.F. helicopter squadrons, No. 155, with Westland Whirlwind HR.4s (Sqn. Ldr. R. C. Penning) and No. 194, with Bristol Sycamore HR.14s (Sqn. Ldr. S. R. Hodge), have quietly revolutionized many of the tactics of jungle warfare, while the short-landing Prestwick Pioneers of "B" Flight, No. 267 Squadron (Sqn. Ldr. E. L. Connor), have made their own unique contribution to the Malayan campaign. This is particularly critical economically, and the Pioneers have been invaluable in performing many jobs which previously could only have been done by helicopter, but at half or one-third of the cost. When it is realized that the cost of operating, for example, a Whirlwind in this campaign, is reckoned at more than three times that of a Pembroke, the reluctance to use helicopters for anything except the most vital jobs becomes obvious. Apart from their operating cost, helicopters are also used with great discretion because of their relatively short-life components, such as rotor blades, hubs, etc., which impose spares and maintenance problems.

The main task of No. 155 Squadron is the tactical movement of troops into and from jungle clearings, and during their three years in Malaya, the unit's Whirlwinds have lifted more than 50,000 personnel without injury. In many cases, the clearings are blasted out of the jungle after trees have been blown down by explosives, and a small landing platform is levelled in the centre. As the trees in Malaya are 200-250 ft. high, a fair number of them must be cut down to provide a reasonable approach path for the Whirlwinds, which have virtually no power margin in the tropical conditions, and very little vertical performance outside the ground cushion.

Photographs copyright "The Aeroplane"

Operations into the heart of the Malayan jungle are undertaken by the single-engine Westland Whirlwinds (upper) and Bristol Sycamores (lower) of Far East Air Force. Both perform extremely well under very difficult conditions.

The Sycamores of No. 194 Squadron are complementary to the Whirlwinds, being able to go into smaller clearings with smaller loads, which automatically gives them a casualty-evacuation rôle, although they are also used for light communications and help out with troop lifts on occasions. Compared with the Whirlwinds, however, the Sycamores are slightly limited in requiring relatively smooth ground, to avoid the possibility of ground resonance, and usually operate from football pitches, roads or other prepared surfaces. On the other hand, when the occasion requires, as we saw for ourselves, they can fly into and out of the smallest jungle clearings, surrounded by tall trees, and they have an excellent hovering performance at altitude which makes them particularly valuable in Malaya.

An important point about all the flying personnel at Kuala Lumpur is that they are all veterans, of mature years, and with an average range of flying experience between 3,000 and 6,000 hr. For the type of operations they perform, this amount of experience is absolutely essential, and although in the past F.E.A.F. has had the highest accident rate in the R.A.F., no other Command flies so close to the absolute limit of aircraft performance, weather and topography. In the case of the Air Supply Force, which at the time of our visit was commanded by Flt. Lt. K. J. Robinson, the Valettas on detachment from Changi, assisted by a few Bristol Freighters of the R.N.Z.A.F., must often penetrate cloud to enter mountain-ringed valleys and fly low in turbulent air over the trees to parachute their loads into small jungle clearings.

Another hazardous job is performed by the Dakotas (the last in the R.A.F.) and Auster 6s of "C" Flight, No. 267 Squadron, which are engaged on voice-broadcasting duties to deliver messages and instructions to terrorists and army units in the jungle. To ensure clear reception, the Dakotas are

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flown on the verge of the stall while broadcasting, at an average 65-70 knots, and this is done quite frequently in the mountains, at night. Four loudspeakers weighing 300 lb. are mounted on a rack under the Dakota centre-section, and inside the fuselage are Diesel generators, amplifiers and tape recorders weighing another 800 lb. Recorded messages in various languages and dialects each last for about 28 sec., from about 2,500 ft. above the ground, which enables listeners on the ground to hear the entire text.

The voice-broadcasts, in conjunction with leaflet dropping, have proved quite successful in encouraging surrenders, and messages from former terrorists are frequently addressed to individuals by name, to good effect. It is rather difficult to keep the Dakotas serviceable, because of their spares problem, and replacement Pratt & Whitney R1830 engines in many cases are Sunderland units, with different mountings. Sharing the hazards of voice-broadcasting, but with only one engine, the Austers are used when the cloud base is too low for the Dakotas, and fly at 900-1,300 ft. above the ground. They have two 500-W. loudspeakers, instead of four, and one amplifier.

No. 267 Squadron's Pioneers share with the helicopters the job of supplying the jungle forts with rations, and changing the garrisons, and these police and army posts simply could not have been built and manned without air support. The Pioneers do a regular round of about 18 forts, with some pretty horrifying air strips, and like the helicopter crews, their pilots fly very many hours over the inhospitable jungle behind a single engine. Fortunately, the only complaint about the Pioneer's powerplant is from the maintenance point of view, in that an engine change apparently takes about 90 man hours.

The Leonides installation in the Pembroke, which equips "A" Flight of this most varied squadron in the R.A.F., is much less trouble from the maintenance point of view, and the aircraft are employed to good effect on communication and V.I.P. transport duties to all the major airfields in Malaya. We hope to amplify these brief details of the fascinating jungle supply operations at a later date, but in the meantime this survey of F.E.A.F. may come as a reminder of the splendid work which is being done overseas by the R.A.F. under difficult and hazardous conditions, in the best traditions of its 40 years' history.— J.E.F.

Second Tactical Air Force

Air Marshal J. H. Edwardes Jones, K.C.B., C.B.E., D.F.C., A.F.C., Commander-in-Chief, Second Tactical Air Force.

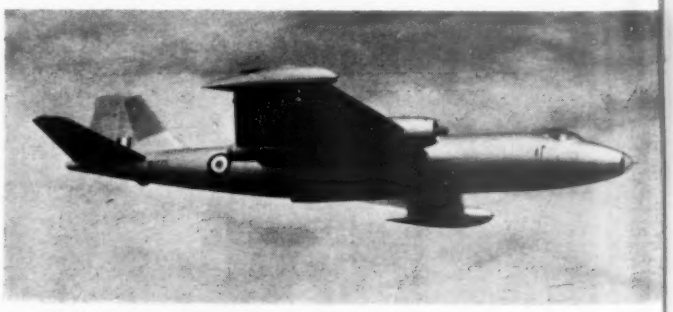
DURING the past year, in accordance with the classic Defence White Paper published early in 1957, 2nd TAF has been reduced in strength by something in the region of 50 per cent., but its effectiveness has been maintained as evidenced by the announcement of its nuclear capabilities. Its rôle of establishing air superiority in Northern Europe, and supporting the NATO armies under SACEUR, has remained unchanged, but its ability to react quickly and heavily to an aggressive threat is being increased.

The organization of 2nd TAF is being streamlined, within the framework of NATO's 2nd Allied Tactical Air Force—which in turn is being modified to become a more representative Allied formation. In the past, 2nd TAF has been a preponderant part of 2nd ATAF, with a common R.A.F. Commander-in-Chief, who at present is Air Marshal J. H. Edwardes Jones, K.C.B., C.B.E., D.F.C., A.F.C., but over the next few years an increasing contribution is planned from the German Luftwaffe, to join the British, Belgian and Dutch units.

At the moment, the general structure still comprises No. 2 Group, with British and Netherlands units, and H.Q. at Sundern, under Air Vice-Marshal S. R. Ubee and No. 83 British-Belgian Group at Wahn, commanded by Air Vice-Marshal H. V. Hogan. No. 2 Group has controlled operationally bases in Northern Germany, including the Netherlands tactical bases of Eindhoven and Volkel; and in addition to the remaining R.A.F. bases in Germany, 83 Group has included the tactical airfields of Petit Broughel, Bierset and Florennes, in Belgium. This organization is unlikely to continue for very much longer, however, and the Groups will probably be replaced in due course by sectors, manned by British, Belgian, Dutch and German personnel.

Plans for 2nd TAF contraction and redeployment have been on the assumption that many of its commitments would be handed over to the new Luftwaffe. This is due to become an effective fighting force by about 1962, but there are indications that it has fallen behind its planning schedule, and although it has taken over a number of airfields from 2nd TAF, the Luftwaffe is not able to put any operational units into the field.

Before last year's White Paper decisions, 2nd TAF was shouldering the entire air defence burden of Germany, which



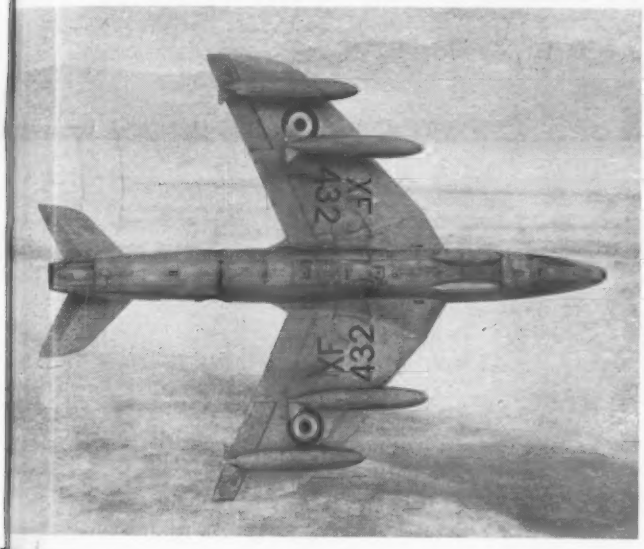
Above, an important part in atomic warfare is played by reconnaissance aircraft, and in this respect 2nd TAF is well served by four squadrons of Canberra PR 7s, for long-range sorties at high or low levels.

Left, the Meteor NF. 11s of 2nd TAF (these are from No. 256 Squadron) are being progressively replaced by Gloster Javelins, but three squadrons are still operating with the older aircraft.

was obviously becoming an insupportable financial load. The reduction in air strength therefore concerned almost the entire day fighter-ground attack element of the R.A.F. in Germany, and was designed to coincide with the formation of an equal number of Luftwaffe fighter squadrons. These are being equipped with Canadair Sabre 5s and 6s for day interceptions, and with Fiat F-86Ks for all-weather fighting, but only some of the former type have so far been received.

The cut in 2nd TAF mainly involved the disbandment of the three Wings, or eight squadrons, of Venom fighter-bombers, which were in any case approaching obsolescence, but also included three or four squadrons equipped with the older Mk. 4 Hunters. Several Hunter squadrons were left in service in Germany for the defence of specific installations, and these have received the later Mk. 6 aircraft, with greatly increased thrust and available fuel capacity.

Second TAF also retains its all-weather fighter element of four squadrons, which is being reinforced by the gradual replacement of Meteor NF 11s by Gloster Javelins of various marks. No. 87 Squadron was the first all-weather unit to re-equip, when last year it received the Javelin FAW 1s formerly operated by No. 46 Sqn. at Odiham. These have proved remarkably successful in service, but will be followed by more



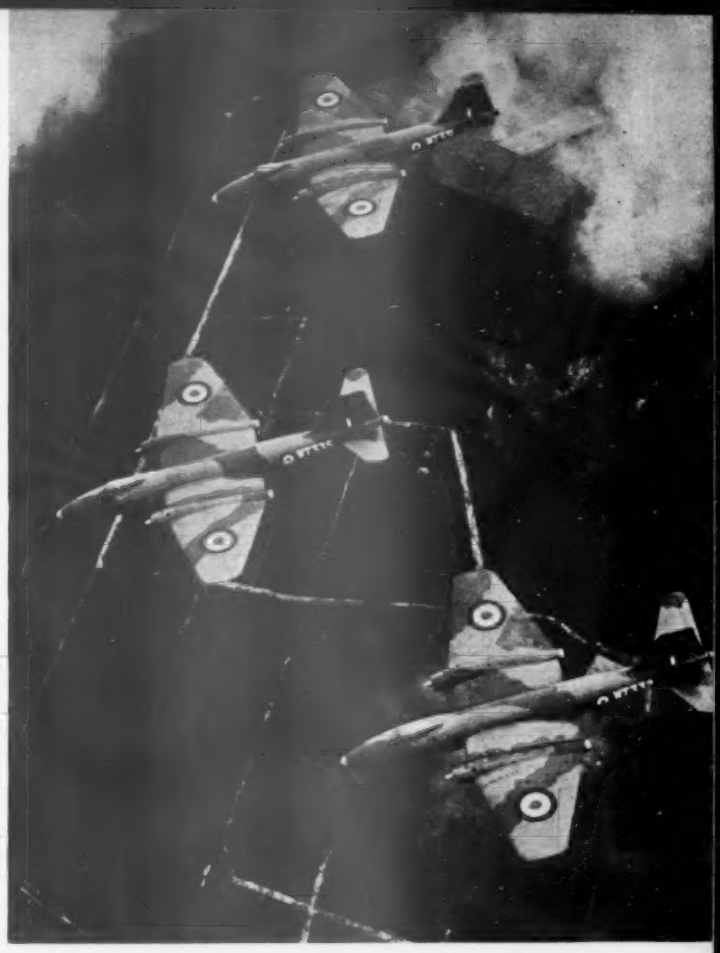
advanced marks of Javelin, including 4s, 5s and 6s, with improved equipment and performance. These will be operated by the other all-weather units, comprising Nos. 68, 96 and 256 Squadrons.

Other sections of 2nd TAF untouched by the recent cuts are the strike and reconnaissance elements, which make up a balanced force for tactical duties. As there are four photographic reconnaissance squadrons in the Command—Nos. 17, 31, 69 and 80—with Canberra PR 7s, it seems highly probable that these will share the same airfields as the all-weather fighter units, and will be situated West of the Rhine at Wildenrath, Laarbruch, Brüggen and Geilenkirchen. The Canberra squadrons include both high- and low-level PR duties in their operational task, in keeping with the revised tactics for nuclear warfare, and among the many virtues of their aircraft is an excellent operating range.

For shorter penetrations at high speed and low level, from front-line airfields, 2nd TAF has available two squadrons of Supermarine Swifts. Since its introduction into service, in 1956, with No. 2 Sqn., then at Geilenkirchen, the Swift FR 5 has thoroughly confirmed the excellent initial impression conveyed by its performance and handling, and has also replaced the Meteor FR 9 in No. 79 Sqn.

With reheat for rapid acceleration, a generous fuel capacity for low-level endurance, and a transonic performance, the Swift has proved very popular with its pilots, despite the fact that it was not designed at the outset for this type of operation. Because of the substantial airframe fatigue factor imposed by prolonged low-level operations at high speed, the Swifts are being withdrawn from service in Germany after several hundred hours' flying.

Another aspect of aircraft conservation in 2nd TAF concerns the introduction of a nylon crash-barrier at the end of airfield runways, to arrest machines with little or no damage in the event of brake failure, or abandoned take-offs. After numerous designs had been studied, including the U.S.A.F. type



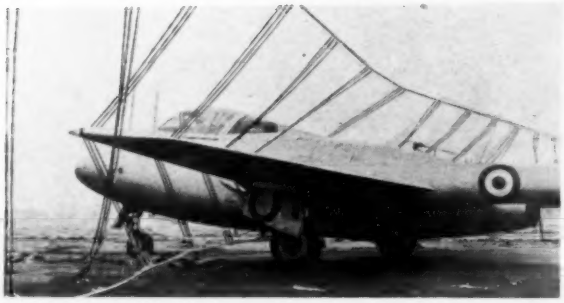
Above, the Canberra B(I)8s of 2nd TAF are now known as Light Bomber Intruders, instead of Interdictors. Left, although about a dozen fighter/ground attack squadrons have been disbanded in Germany, several interceptor squadrons remain for the defence of specific targets, with Hunter F. 6s.

which uses anchor chain as a retarding medium, and takes a considerable time to erect, the Swedish "Safeland" barrier, produced by the BEFAB company, was selected for trials in 2nd TAF.

The first installation was at Aahlhorn, and the barrier, which uses a simple pneumatic brake system for energy absorption, was fitted so that it can be erected in a few seconds at the touch of a button in flying control. For the cost of about £15,000, for the fighter size barrier, it soon paid for itself by arresting a runaway Venom, and has come to be highly regarded by 2nd TAF aircrew. Following its successful trials, it will probably be ordered for all remaining British airfields in Germany, as well as those in the U.K., and in its larger size, with a deeper nylon net, is capable of arresting aircraft up to the size of the Valiant.

At its peak strength in recent years, 2nd TAF occupied about 15 airfields in the former British zone of Germany, but this number has been considerably reduced by the reduction of R.A.F. squadrons and the handing-over of bases to the Luftwaffe. Those returned to German administration have so far included the advanced bases at Fassberg and Celle, and Wunstorf, Oldenburg, Wahn, and Bückeburg. Gütersloh is at present being extended for 2nd TAF jet operation, and on its completion the station at Aahlhorn will be handed back to the Germans. It is probable, however, that British and German squadrons assigned to NATO under the operational control of 2nd ATAF may share the same airfields.

The main offensive force of 2nd TAF is undoubtedly the Canberra strike wing of four squadrons, equipped with B(I)6s and 8s. Hitherto, the rôle of these squadrons has been known as interdiction, but following a recent decree by SHAPE, the Canberras have been redesignated as Light Bomber Intruder (LBI) aircraft. This is in keeping with their wider responsibilities since adding nuclear capabilities to their conventional armament, and their adherence to "over-the-shoulder" delivery of atomic weapons with the assistance of LABS (low-altitude bomb-sight). This equipment enables a bomb to be delivered at a pre-computed angle, airspeed and *g*-loading, after a target approach at very low altitude, and the aircraft then



Above, the Swedish "Safe Land" emergency arrester barrier has been adopted by 2nd TAF, following successful trials with its operational use at Aahlhorn, and is seen here stopping a Vampire Trainer. Right, reheat climb by a Swift FR 5 of No. 79 Sqn.

climbs up into a half-loop before rolling out and returning on a reciprocal landing.

The long-range low-level sorties require a high degree of skill and practice in navigational techniques, and the other aspects of Light Bomber Intruder operations, including high-altitude bombing and ground attack combine to present an impressive training problem. The first unit to study the original processes of night interdiction was No. 213 Sqn., which is the only R.A.F. unit to operate the interim, but successful, Canberra B(I)6, and this has since been joined by three B(I) or LBI Mk. 8 Squadrons.

In its new form and stripped, as it were, of superfluous fat, 2nd TAF is equipped not only for survival in this nuclear age, but also as a powerful deterrent and retaliatory force, under the Supreme Allied Commander, Europe. In future, it will be backed by a larger percentage of Allied airpower, in 2nd ATAF, but it will still remain the predominant striking force in Northern Germany.—J.E.F.

The R.A.F.'s New Equipment

Air- and ground-launched guided missiles are to form the basic defensive armament for the future R.A.F. and weapons of this type are now in production. Here, above, is the Bristol Bloodhound surface-to-air weapon; left, the English Electric Thunderbird surface-to-air weapon; and below, an English Electric P.1B armed with its Firestreak air-to-air missiles.

R.A.F. 40th Anniversary . . . .

The R.A.F. in the Second World War

by Air Marshal Sir Robert Saundby

IT is not possible in this article to deal, even briefly, with all the activities of the Royal Air Force during the Second World War, and it is therefore necessary to select what seem to be the most important and interesting aspects of its great contribution to victory.

In order to appreciate fully the part played by aircraft, and to understand the reasons for what happened, some reference must be made to the principal events that led up to the situation existing on the outbreak of war in 1939.

The First World War ended without giving any clear indication of the offensive power of aircraft, and during the 20 years from 1919 to 1939 a lively controversy was carried on between the three Services as to the correct organization and employment of air power.

Both the Navy and the Army took the view that aircraft were ancillary weapons, possessing little offensive power but useful and, indeed, invaluable for the support of sea and land operations. They therefore contended that all aircraft should be owned and controlled by the two older Services, and they never fully acquiesced in the existence of the R.A.F. as a third, co-equal, and separate Service.

The Disarmament Conference at Geneva, in 1931-32, was considering the total abolition of military aircraft, or, if that could not be achieved, sharp restrictions on their all-up weight, designed to remove serious offensive power from the bomber. While all this was going on the Air Force was not allowed to order modern bombers, and even research work into the offensive use of air power almost ceased.

The combined effect of the Disarmament Conference, the British financial crisis in 1931, and the unhelpful attitude of the older Services, was crippling. The Air Force was maintained at so low a level that it was almost impossible to retain the minimum framework on which a future expansion could be based. In addition, stocks of all kinds, including bombs, ammunition, and spare parts were allowed to run down to a very low ebb.

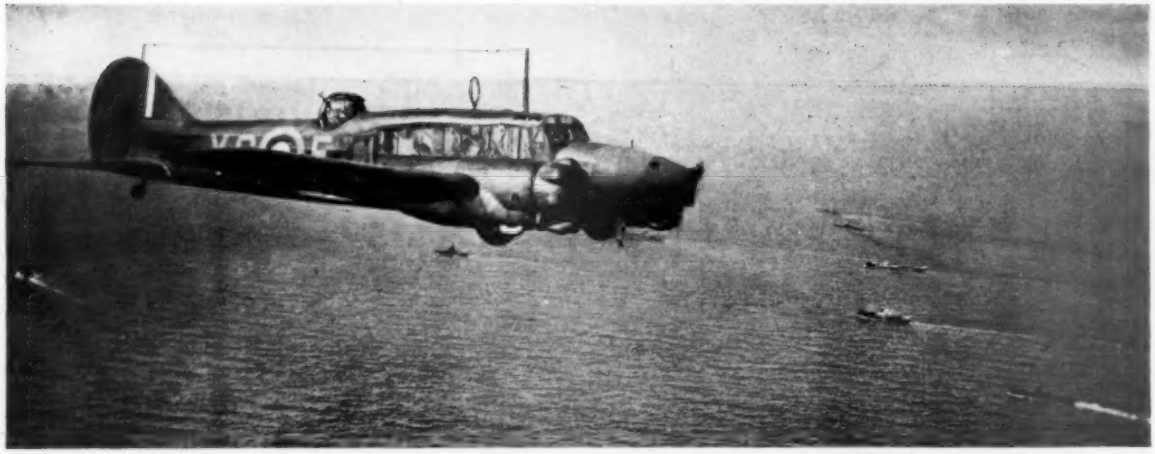
Soon after Hitler came to power in 1933 the German military air force was officially established. They had already trained a large number of pilots and had built many pseudo-civilian aircraft, and in a short time their Air Force was little if anything inferior to the R.A.F., and was rapidly expanding. Sir John Simon, then Foreign Secretary, made a report after a visit to Germany which opened the eyes of the Government to the realities of the situation. An expansion of the R.A.F., small at first, was put in hand but, as uneasiness in the country increased, scheme followed scheme until, late in 1935, a large measure of expansion was authorized.

The Air Staff had always believed that such an expansion would come sooner or later, and they had taken such steps as were open to them to prepare for it. When money was very short, the building of peace-time barracks and quarters had been postponed, and war-time huts and similar accommodation were made to serve. They spent what money they could in keeping the aircraft industry alive, with its all-important design staffs and drawing offices. But, in spite of all they could do, the industry was very hard hit, and many firms could scarcely maintain their existence. This country owes not a little to those men who refused to cut their losses and shut up shop, but hung on in the belief that our safety would one day depend on the existence of a substantial and well-equipped aircraft industry.

Secondly, the Air Staff spared no pains to think out their problems well in advance. Two very important committees were set up, under the chairmanship of Sir Henry Tizard, to study the offensive and defensive aspects of air warfare. These committees included distinguished scientists such as Sir Charles Darwin, Sir Edward Appleton, Sir Robert Watson-Watt and others, and senior officers of the Air Ministry. I had the honour to serve on both these committees, which I think were the first example of a Service Ministry obtaining the assistance of a team of leading scientists to help in the solution of its problems.

The Air Staff recognized that if war came there would be an opening defensive phase, during which we should have to deal with a large-scale air attack on this country. Only if we survived that phase could we hope to develop our own air

R.A.F. bombers—Vickers-Armstrongs Wellingtons and Handley Page Hampdens—are seen here at Le Bourget airport, Paris, a few weeks before the War began in 1939. They took part in the review of the French armed forces during the Fête Nationale celebrations on July 14 that year. At this period long-distance training flights were being made by R.A.F. bombers over France.



"Faithful Annie," as the Avro Anson was affectionately known in the R.A.F., is seen here on convoy patrol over the North Atlantic. Powered by two Armstrong Siddeley Cheetah engines the Anson was produced for the General Reconnaissance squadrons formed in 1936 and was later used for training and communications. Many are still in use in the latter category.

offensive in its turn, and the air defence organization and fighter production therefore had first priority.

The problem of fighter defence is two-fold. First, there is the problem of interception, of getting the fighter into the right position to attack the bomber. With bombers flying at 200 m.p.h., the time for interception was short. The Tizard Committee for the Scientific Survey of Air Defence recommended the use of radio-location, later known as radar, to help in its solution, and this was eagerly accepted. Secondly, the difficulty of interception is so great that there should be no doubt about the fighter's ability to kill the bomber when he found it. It followed from this that the fighter should have ample gun-power. On these two principles, radar to effect interception, and the multi-gun fighter to make sure of the bomber when intercepted, we based the organization of our air defence system

In 1933, the requirements for the multi-gun fighter, which produced the Hurricane and Spitfire, were put out by the Air Staff. At that time it took about five years from the issue of the requirements to the introduction, in substantial numbers, of a new type of aircraft to the Service. In 1938 the Hurricane was beginning to come along with the Spitfire about a year behind it.

In 1934, after the fighters had been specified, new requirements for bombers were issued. These requirements produced the Whitley, which was a conversion from an existing design, the Hampden, and the Wellington of geodetic construction invented by Dr. Barnes Wallis, the designer of the airship R100 and of the special weapon which destroyed the Mohne and Eder dams. The Whitley and Wellington carried power-operated tail turrets equipped with two and later four machine guns, which was an entirely new feature and gave some hope that these aircraft would be able to carry out attacks in daylight against fighter opposition.

In 1936 our requirements for four-engined heavy bombers were put out, to which were built the Stirling, Halifax and Manchester, later converted to the Lancaster.

The Munich crisis, in September, 1938, which abruptly raised the threat of imminent war, seriously shook everybody concerned with our preparations for defence. As far as the Air Force was concerned, we had a few Hurricanes but no operational Spitfires. Only a small number of bombers of the 1934 specification were available. The chain of 20 radar stations was being built, but only a few were operational. The supply of .303 ammunition, which was a War Office responsibility, was deplorably inadequate.

We just had not had time to recover from the disastrous state of complete unpreparedness into which the Services, owing to our futile attempt to set an example by unilateral disarmament, had been allowed to fall I have not the slightest doubt that if war had come then our defeat would have been swift and inevitable.

War was, with difficulty, averted and we breathed again; but we knew that we had no more than six or, possibly, 12 months in which to prepare for a full-scale war against Germany. Since the general public had little or no idea of the danger of our position, it was difficult to hasten substantially the tempo of re-armament. Most of the spade work, however, had been done and we were now anxiously awaiting the delivery of the finished articles.

The mass-production of modern war weapons resembles, in many ways, the growing of an agricultural crop. If you want wheat, you must acquire suitable land, plough and sow it, and wait for the wheat to grow. For some time you get nothing and then, one day, the crop is ripe and ready for reaping, and in a comparatively short time you have abundance of wheat. So with the production of aircraft. Our plans had been made; the factories built and the labour force collected; the new types of aircraft had been designed and tooled-up for production.

By the beginning of 1939, the time of reaping was at hand. When war came in September of that year, Fighter Command had been largely re-equipped with Hurricanes, and the Spitfires were beginning to arrive in the squadrons. In many directions, however, there were still serious deficiencies, and the longer we could postpone the trial of strength the better.

We were, of course, extremely anxious to test our theories in battle, as it was most important that we should know how they worked, and discover any weaknesses while there might yet be time to remedy them. There was, as yet, no fighting in the West and the Government was resolved to drop no bombs on German soil. It was therefore decided to use our bombers in daylight to attack the German warships anchored off Wilhelmshaven, Cuxhaven and other ports.

Unfortunately, however, a large number of German fighters were concentrated in this area and the attacks failed with heavy casualties. Our bombers had not, at that time, been equipped with self-sealing tanks and so a single hit with an incendiary bullet might destroy a bomber. These tanks were being produced, but priority had rightly been given to the fighters. Every effort was made during the next few months to fit all our bombers with this protection against fire, and by April, 1940, when the fighting in the West began, this aim had been largely achieved.

But the effect of this failure was far-reaching, since it influenced the Air Ministry to concentrate on bombing by night, a decision that was generally maintained until the summer of 1944.

Our fighter squadrons based in France, part of the Air Contingent sent there to support the Expeditionary Force, sought every opportunity of bringing enemy aircraft, and especially enemy bombers, to battle. Combats were few, as the Germans did not offer many chances, but we obtained enough experience to convince us that the 8-gun fighter would fulfil all our expectations. We were even able to analyse the combats and deduce from them the best alignment of the battery of eight guns.

These analyses were made by our new Operational Research Sections. One of these Sections, staffed by scientists, had been set up at each Command Headquarters. After the outbreak of war they were expanded and greatly strengthened by the addition of many first-class men. Operational problems of all kinds were submitted to them for statistical analysis and recommendations. They were able to consider them impartially, sift truth from illusion, and even calculate the odds in favour of success or failure. Their recommendations proved most valuable and accurate, and it would be difficult to overestimate the value of the work done by these Sections They undoubtedly did very much to ensure the relative scarcity of failure which characterized Air Force operations during the war.

From every point of view the respite of six months after the

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(*Continued from page* 440)

outbreak of war, before we were called upon to meet the full strength of the Luftwaffe, was of the utmost value. It is perhaps not too much to say that it made the difference between victory and defeat in the opening defensive phase.

By the spring of 1940 the forces of both sides were poised for battle. Fighter Command was standing by, with a chain of newly completed radar stations round our coasts, to carry out its task of defending this country against air attack. It was mainly equipped with Hurricanes, with two squadrons of Defiants, a two-seater fighter that did not prove very effective, and two or three squadrons of Spitfires.

Bomber Command, which had rightly been given a lower order of priority, was not so ready. Though it had a fair number of Whitleys, Wellingtons and Hampdens, it also had a considerable proportion of older types, such as the Battle and Blenheim, which were of limited usefulness.

An Air Contingent, consisting of Hurricane and light bomber (Battle and Blenheim) squadrons, was in France to co-operate with our Expeditionary Force.

Coastal Command, equipped with long-range flying-boats and shorter range land-based aircraft, was striving, in co-operation with naval forces, to defeat the enemy's submarine campaign.

The first move in the West was a surprise attack by Germany on Denmark and Norway on April 9, 1940. Denmark fell without a struggle, but Norway resisted, and we decided to send a military force—which had been prepared to go to the assistance of Finland, and was readily available—to help them. The expedition provided a very important test case, the result of which did much to settle a controversy that had been going on between the Services ever since the end of the First World War.

In the view of the Air Staff a reasonable degree of air supremacy was needed before any sea or land operation could be successfully undertaken. In this case we were proposing to send a military expedition across the North Sea relying on our sea power to escort it there and maintain its sea communications. According to Air Staff doctrine it was bound to fail, because the distance from this country was too great for effective land-based air support, and the expedition therefore had to rely on support from aircraft carriers, and from such air forces as could be established in Norway in the face of strong opposition from German land-based air forces.

Two questions arose. Would our naval superiority enable us to land and maintain a force in the face of German air superiority? If it were able to do so, could our expedition succeed in spite of the inevitable inferiority of its air support?

We were not left long in doubt as to the answer to both questions. The expedition got ashore, but we were unable to build up our air forces. The squadrons that were sent to Norway, in spite of the most gallant efforts, were destroyed by the Luftwaffe almost before they could operate. German air attacks on our ports in Norway and on our sea communications were so damaging that it soon became clear that we could not maintain our forces ashore. The withdrawal was skilfully carried out and our losses were, considering the circumstances, light. It is sad to record that most of the gallant survivors of our air squadrons, who were being brought home in the aircraft carrier "Glorious," were lost when that ship was sunk in the North Sea by the "Gneisenau" and "Scharnhorst."

This was the first occasion on which the truth of this Air Staff doctrine was clearly demonstrated, but the subsequent course of the war furnished many proofs of its validity.

In early May, the Germans violated Dutch and Belgian neutrality, forced the gap in the Ardennes north of the Maginot Line, and drove the British Army back towards the Channel coast. The light bomber contingent in France, supported by Bomber Command operating from this country, fought a gallant but hopeless battle against great odds. They bombed in daylight, from very low heights, in the face of a murderous German light A.A. fire, many bridges, traffic bottle-necks and concentrations of armoured forces. Their casualties were terrible, but they were unable to stop or even seriously hamper the advance of the German panzer divisions.

Holland and Belgium laid down their arms, and the French armies, the flank of their Maginot Line turned, were impotent. It was decided to withdraw our troops from France, using every vessel that could be made available. Fighter Command, concentrated on a few airfields in South-East England, made a desperate and successful effort to keep the Luftwaffe at bay while some 330,000 British and French troops were brought back to this country.

In this disastrous campaign the R.A.F. lost nearly 1,000 aircraft, including about 400 bombers and their valuable crews, who were the seed-corn of our future expansion.

When France fell, the strategy with which we had begun the War lay in ruins all about us, and we realized that, in a short time, we should have to face the full weight of Germany, alone and unsupported.

Although we did not know it, and indeed scarcely dared to hope for it, we had until the beginning of August to make good our losses and prepare ourselves for the supreme trial of strength. During that time the Germans organized airfields in France, Belgium, Holland, Denmark and Norway, from which to operate their air forces against Britain. They also collected, in the Channel Ports, massive quantities of barges, troops and supplies for a sea-borne invasion of this island.

For some two months, therefore, Fighter Command was able to rest, re-form and recuperate, but night after night Bomber Command pounded away at the invasion ports, smashing and sinking barges, destroying supplies, and causing the dispersal of the troops. The value of this action has not, I think, been fully recognized. A study of captured documents has proved that it was a big factor in forcing the Germans to abandon their plans for invasion.

The course of the Battle of Britain is well known. The German bombers, designed mainly for army support, were inadequately armed—they had no power-operated turrets—and they were highly vulnerable to attacks from eight-gun fighters. The Germans soon resorted to fighter escorts and, although this made the task of Fighter Command more difficult, it did not prove effective and the German losses were very great. The greatest danger was that our air defence might be worn down by sheer fatigue before we could compel the Germans to abandon their assault.

Fighter Command was very small compared with the Luftwaffe concentrated for the attack on this country—it was outnumbered by more than five to one—and our fighter pilots could get no proper rest. The Commander-in-Chief, Fighter Command, had to do everything possible to rest and husband his forces, in order to avoid a breakdown through physical and nervous exhaustion. The supply of aircraft to replace wastage caused some anxiety, but it was the human factor—the pilot—that was the chief limitation of our effort. But no one who saw them at that time can ever forget the cheerful willingness, the determination to "press on regardless," of those tired, over-strained young men.

The battle did not end dramatically, but gradually died away, though towards the end of September it was clear that we had won. It had been a very near thing, but the 20 months between the Munich crisis and Hitler's attack on France had allowed just enough time for preparation.

The Germans then turned to night bombing, in an attempt to break the morale of our civilian population. At first we

The Fairey Battle, an early monoplane to enter squadron service with the R.A.F., had a Rolls-Royce Merlin engine and was designed for day-bombing duties. With the A.A.S.F. in France in 1939-40 the Battle was used mostly for reconnaissance over the Siegfried positions.

Produced as a military development of the Short Empire flying-boat, the Sunderland (above), first entered squadron service with R.A.F. Coastal Command in 1938. Long - range Atlantic patrol, rescue and evacuation operations and anti-shipping attacks were among the duties of this versatile aircraft. Illustrated here is a Mk. I of No. 210 Squadron, powered by four Bristol Pegasus XVIII engines.

The Bristol Blenheim IV (left), the so-called "long-nose" version, was developed from the Blenheim I bomber of 1936, and was used for fighting both by day and by night and as a bomber. That illustrated is a Mk. IV L.

had little defence against this form of attack, and London and our industrial cities suffered fairly severe damage.

Interception of the night bomber was a new and difficult problem. A good deal of thought had, however, been given to it before the War, and airborne radar proved to be the solution. In 1938, we had arranged to convert the Beaufort, a fast, twin-engined reconnaissance aircraft, into a night fighter. Renamed the Beaufighter, it carried four 20-mm. Hispano guns, and a bomber attacked by it had little hope of survival. It came along none too soon, and gradually we learned the technique of night interception. By the spring of 1941, the enemy's losses had become serious. The German Air Force had not been trained for night bombing and, in addition to battle casualties, they had a high rate of wastage due to accidents and indifferent navigation. The frequency and weight of their attacks diminished, and at last it was clear that we had successfully weathered the opening defensive phase of the War.

The next phase was now about to begin and, although we had survived the first onslaught, the situation was far from good. Our armies had been withdrawn from the Continent, with the loss of almost the whole of their guns, tanks, M.T. vehicles, and heavy equipment. It would take a very considerable time to re-arm our divisions, and incorporate in their training the lessons we had learned.

Under the threat of air attack, now at last regarded seriously, the Navy had withdrawn everything except some destroyers and small ships from the narrow waters of the Channel and the southern half of the North Sea, and in co-operation with Coastal Command was fully occupied in keeping open our sea communications.

The Air Force had, so far, been compelled to carry a large part of the burden of the War, and had saved us from defeat. It had emerged successfully from a terrible ordeal, but had suffered very severe casualties. These losses made more difficult the expansion that must be achieved if we were to have any hope of eventual victory.

In early June, 1940, Mussolini decided that we were about to lose the War, and that the time had come to align himself with the winning side. The beginning of this new phase of the War found us with some 300 first-line aircraft in the Middle East, widely distributed in Egypt, the Sudan, Malta, Palestine and Trans-Jordan, East Africa, Aden and Somaliland, Iraq, and Cyprus, of which about half were concentrated in Egypt. Most of the aircraft were obsolescent types. There were 5 squadrons of Gladiators, 13 of Blenheims, Lysanders and Sunderlands, while 11 had a variety of older types, including Bombays, Valentias, Wellesleys, Vincents, Battles, Hardys, Audaxes, Harts and Hartebeestes.

The Middle East Command prepared to meet an Italian attack on Egypt from Cyrenaica. From the beginning the aggressive spirit of the R.A.F. established a defensive mentality in the Italian Air Force. Our resources were, however, very limited and it was necessary to establish a reinforcing route. With France out of the War, we had to fly long-range aircraft by night via Malta, while shorter-range aircraft had to go by sea to Takoradi in the Gold Coast and thence by air across Nigeria, French Equatorial Africa and the Sudan.

The Italians were slow to get going, and the British forces

The Lysander (foreground) was produced by Westland Aircraft primarily for army co-operation duties and served in that capacity with the A.A.S.F. in France during the period of the "phoney war." Later, in conjunction with the Supermarine Walrus (background) it was employed on short-range air/sea rescue work.

took the initiative, driving the Italians back to Benghazi. In the meanwhile we offered aid to Greece, which had been attacked by Italy. The Greeks were not anxious to accept it as they believed that they could hold out, but that if we came to their assistance the Germans would be bound to help the Italians. Nevertheless, it was decided that we should intervene, and a large part of our Middle East Army and Air Force was switched to Greece. The result was wholly disastrous. We were left with insufficient forces in North Africa and lost all that we had gained, while large-scale German assistance to the Italians rapidly drove us out of Greece.

The next episode in this campaign demonstrated very clearly the ability of air forces to counter the effect of sea power in narrow waters. After our withdrawal from Greece it was decided to hold on to the island of Crete. We had naval supremacy in the Mediterranean and it was hoped to use the island as an advanced base. There were good airfields and an excellent anchorage in Suda Bay. But our airfields in North Africa were too far away and the Germans had command of the air over the island and the surrounding seas. They quickly organized an airborne invasion of the island, landed troops by air, seized an airfield, built up their forces and succeeded in making themselves masters of Crete. In addition, the German air force sank several of our warships and we were compelled to abandon the whole area.

After the examples of Norway, the Battle of Britain, and Crete, it could no longer be doubted that the narrow seas were controlled by the power which enjoyed air supremacy, irrespective of the naval situation. Generally speaking, it was apparent that surface ships could not now be successfully operated unless they were beyond the range of land-based aircraft, or were protected by superior land-based air forces. If further proof was required, it was provided by the fate of most of the German heavy ships, and by the sinking of our own "Prince of Wales" and "Repulse" in the waters off Malaya in December, 1941.

In the autumn of 1940 the Joint Planning Committee produced an appreciation of the situation, from which it was clear that the only way in which we could hope to reduce German military strength was by a strategic air bombardment of Germany. The Government therefore decided to carry out a large-scale air attack on the sources of German military power. The ultimate object of this attack was the progressive destruction of German war industry and communications, in the hope of reducing their military strength to a level which would make it practicable for us to return to Europe and deliver the final blow. At that time the difficulties seemed immense.

It was all too clear that the formidable task assigned to Bomber Command could not be successfully achieved without a very great effort. The time had therefore come to switch priorities from the fighters to the bombers, especially the new four-engined heavy bombers, and to speed up the development of radar devices to assist navigation and bomb-aiming.

For a number of reasons, however, the strategic bombing campaign did not receive a high enough priority. It was a new idea, and many people had no faith in it. They pointed out that the German air attack on us had failed, and it was therefore optimistic to suppose that ours would succeed.

In addition, it was not easy to persuade the new Ministry of Aircraft Production that the time was past for concentrating almost entirely on the production of fighters. The Ministry had been formed on May 10, 1940, and throughout its brief existence had been pressed for fighters and more fighters. Some time elapsed before it could be brought to believe that the Air Force now wanted bombers and more bombers, and there was a further delay before it did anything effective about it.

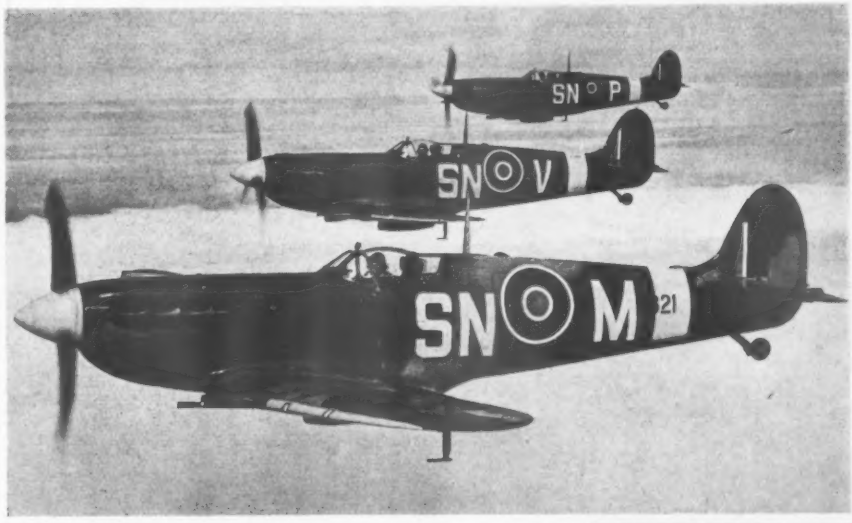
As already recounted, we had suffered a sharp set-back in the Middle East owing to our attempt to fight simultaneously in Greece and North Africa, and large reinforcements were needed to restore the situation. Several complete squadrons and some hundreds of additional aircraft and crews were taken from Bomber Command and sent to maintain and build up our forces in that theatre.

Last, but certainly not least, there were many urgent demands for the use of bombers in various defensive tasks, especially for the attack on enemy warships and submarines. It is, of course, essential to provide the minimum force needed for security, and our shipping losses had been much larger than had been expected. This was mainly due to a serious shortage of suitable armed escort vessels, and the disappointing results obtained by ASDIC, a ship-borne method of detecting submarines.

There was, therefore, a strong case, in view of the comparative failure of the Navy to deal with the German U-boats, for expanding Coastal Command. This could only be done by transferring a considerable number of squadrons from Bomber Command to Coastal Command. A total of 17 squadrons was transferred in this way before the end of 1942.

In addition, the German heavy ships began to operate, in a small way, on our sea routes, and the Admiralty feared that they would cause us serious losses. In fact, these fears were unfounded. The "Bismarck" was caught in the Atlantic and, after being crippled by a torpedo attack launched from an aircraft carrier, was sunk by Naval forces. The battle-cruisers, "Scharnhorst" and "Gneisenau," made a foray into the Atlantic, and sank over 20,000 tons of merchant shipping. They then came into Brest, in the spring of 1941, to refuel. While there they were attacked by Bomber Command and repeatedly hit.

The attack of these ships was the first occasion on which



Gaining a reputation for superb handling qualities and fighting ability, the Supermarine Spitfire (left) was an outcome of the seaplanes designed by R. J. Mitchell for the Schneider Trophy contests. No fewer than 20,351 Spitfires of all variants and powered by Rolls-Royce Merlin or Griffon engines, were built for the R.A.F. Illustrated here is the Mk. VB, with two 20-mm. cannon and four 0.303-in. machine guns.

Below, Hawker Hurricane IICs (Rolls-Royce Merlin engine) of No. 1 Squadron. Like the Spitfire, the Hurricane served on all fronts and in many different categories; the "Hurri-Bomber" carried two 500-lb. bombs.

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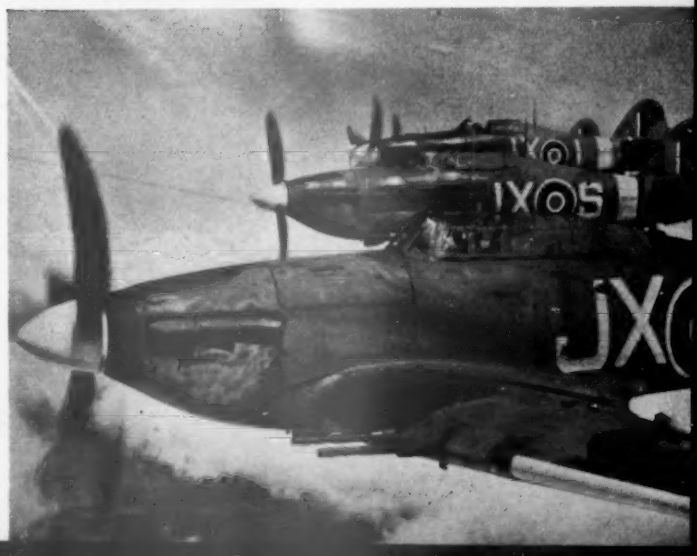

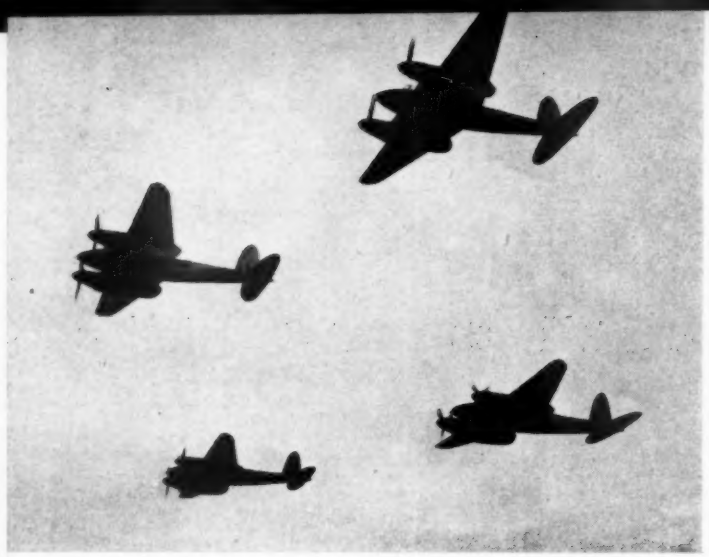

The all-wood D. H. Mosquito set a new standard in R.A.F. aircraft, the first bomber versions being virtually unarmed. Subsequently developed for fighting, night-intruder duties (as illustrated) and torpedo dropping, the Mosquito was built in large numbers in Canada and Australia besides the United Kingdom.

radar devices were used to assist the aiming of bombs. The devices were primitive, but Bomber Command learned a great deal from this experiment. Although, as time went on, the two ships were defended by numerous anti-aircraft guns and hidden by smoke screens, the Germans could never get them fit for operations. On the other hand, we were unable to sink them as they were kept in dry docks at the French Naval base. Eventually the ships were patched up sufficiently to make a dash for Germany in bad weather.

Both ships were damaged by mines laid by Bomber Command. The "Scharnhorst" crept into Wilhelmshaven and was beached, while the "Gneisenau" limped on to Kiel. Here she was bombed again and so severely damaged that she was towed, stern first, to Gdynia, near Danzig, and eventually dismantled. Her guns were removed and used for other purposes. It took the Germans nearly two years to repair the "Scharnhorst," and when she appeared again to threaten a British convoy bound for Russia, she was sunk by the Navy.

After they put into Brest in early 1941, neither the "Scharnhorst" nor the "Gneisenau" ever sank another British ship. The "Tirpitz," warned by the fate of the "Bismarck," took care never to emerge from the comparative safety of German waters. She never caused us any shipping losses, and ended her inglorious career when she was destroyed off Norway by Bomber Command in 1944.

All this was very satisfactory, but it diverted many bombs away from Germany. In that sense, and in no other, these ships served Germany well.

The Admiralty, however, continued to urge that a large part of Bomber Command should be used for long-distance anti-submarine patrol. This was a most dangerous proposition, because an almost unlimited number of heavy bombers could have been absorbed in this defensive task, with very little result. There is no doubt that the Germans would have liked us to use our heavy bombers in this way, for their propaganda never ceased trying to convince us that strategic bombing was futile.

Fortunately, the War Cabinet would not approve this proposal. Had they done so, the subsequent history of the War must have been very different. We might have saved a few ships, but we should certainly not have been in a position to invade France in 1944.

By the beginning of 1943, however, the bomber offensive against Germany was producing substantial results. Bomber Command had been joined by the United States 8th Air Force, which began to operate in August, 1942. Since the 1,000-bomber raid on Cologne, in May 1942, the success of which stirred the imagination of the Prime Minister, Bomber Command had enjoyed a high priority. By the spring of 1943 it was much expanded, and largely re-equipped with 4-engined heavy bombers. Attacks of a weight comparable with that of the first 1,000-bomber raid could now be carried out as a matter of routine.

Bomber Command still continued to bomb by night. The U.S. 8th Air Force, on the other hand, was trained and equipped for day bombing. Each method had its advantages and disadvantages, and there was little to choose between them for accuracy, but the arrangement had the great merit of enabling us to keep up the attack of Germany by day and night, all through the 24 hours. Their defences got no rest, and damage was caused at a rate which far exceeded their capacity to repair it.

Although Bomber Command mainly relied on high-altitude night bombing, using the Pathfinder technique to find and mark the target for the main force, it also undertook a number of daring and spectacular attacks. The majority of these were to deal with some restricted target in enemy occupied territory such as the very successful low-level moonlight attacks on the Renault factory in Paris, the Gnome-Rhone works at Gennevilliers, and the Ford works at Poissy. The Phillips works at Eindhoven, a large producer of radar valves, was attacked by light bombers of No. 2 Group in daylight.

On April 17, 1942, the important M.A.N. U-boat Diesel engine factory at Augsburg was successfully attacked in daylight by a small force of Lancasters which flew all the way at a low height. A notably successful daylight attack on Milan was also carried out by nearly 100 Lancasters. There were many other daylight raids, including a number of very accurate attacks by Mosquitos on special targets in occupied territory, such as the molybdenum mine at Knaben in Norway.

The outstanding low-level attack by Lancasters in bright moonlight which breached the Mohne and Eider dams is well known.

These attacks not only achieved valuable results, but they helped to raise morale by providing an exciting, if dangerous, alternative to the routine of night bombing. In addition, they kept the German defences guessing, and prevented them from concentrating wholly on opposing high altitude night bombing.

Meanwhile, in North Africa, an improved system of using air forces in support of armies was being worked out. In the First World War, air forces co-operating with the army were split up and control decentralized. Each Army had its air brigade, each Corps it Wing, and each Division its Squadron. This fragmentation effectively prevented any concentration of air power at the decisive time and place, and reduced the most powerful air forces to relative impotence. For that reason the Air Staff had always viewed this procedure with grave misgiving, and were very unwilling to place Air Force contingents under the control of the Army.

North Africa now changed all that. Working with the 8th Army was a Tactical Air Force, under an A.O.C., and containing all the available air forces. The Air Commander worked in the closest touch with the Army Commander. The system worked admirably in practice, and became the model on which army air support was subsequently organized.

In December, 1941, the Japanese made a surprise attack on the United States Fleet at Pearl Harbour, and almost simultaneously advanced against our possessions in South East Asia. Our defence forces were hopelessly inadequate, and reinforcements sent from the Middle East arrived too late to be effective. Singapore, where the main reliance had been placed on heavy guns sited to repel a sea-borne assault, fell before an attack overland through Malaya. Our air forces were crippled at the outset, and the two heavy ships "Prince of Wales" and "Repulse" were sunk by the Japanese Air Force soon after their arrival.

Apart from the excellent work done by the Royal Air Force in support of the 14th Army's campaign in Burma, it took little part in the re-conquest of the vast areas over-run by Japan, which was mainly the responsibility of United States, Australian and New Zealand forces.

The strategic bombing campaign did not become effective until the spring of 1943, for various reasons referred to above, and it continued until the spring of 1944, when the heavy bombers were switched to the preparations for "Overlord." It was therefore really waged against Germany for just about one year. In that time, thousands of German factories had been reduced to rubble, millions of German workers unhoused, transportation of all kinds constantly interrupted, inland waterways put out of action, and large quantities of war material destroyed by fire and high explosive.

After many vicissitudes the 8th Army in North Africa, reinforced, and led by a new commander, General Montgomery, with powerful air support had struck a heavy blow at the Axis forces at El Alamein in October, 1942, and begun a campaign which, aided by the Anglo-American landings in Algeria and Morocco, cleared the enemy out of North Africa. Our forces followed them into Sicily, defeated them again, and set foot on the mainland of Italy.

Then began a slow process of driving northwards, "crawling up the leg of Italy like a harvest bug," as the Prime Minister described it in a characteristic phrase. The co-operation between the Army and the Air Force was exemplary, and in December, 1943, General Montgomery was able to say: "First of all you must win the battle of the air. That must come before a single sea or land engagement. If you examine the conduct of my campaigns, you will find that we never fought a land battle until the air battle was won."

By March, 1944, it was judged that the combined effect of

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strategic bombing and attrition on the Eastern Front had sufficiently weakened Germany, and especially the German Air Force, to make it practicable for the Allied Armies to invade the Continent. Nothing, however, could be left to chance and almost the whole of the Allied Air Forces based in this country were switched to the task of ensuring the success of this difficult and complex operation.*

The crux of successful invasion is the ability to build up the forces in your beach-heads, using sea communications, more rapidly than the enemy can build up his forces in the threatened area, using his land communications. The heavy bombers, therefore, assisted by the 2nd Tactical Air Force and the U.S. 9th (Tactical) Air Force, had the task of destroying the rail and road communications of Northern France. Railway centres, marshalling yards and bridges were the main targets.

As D Day approached, the heavy bombers turned their attention to the destruction of the German defensive works along the French coast—the so-called Atlantic Wall. In order to avoid drawing attention to the proposed landing places, the destruction of communications and defences had to be carried out from the Pas de Calais to Brittany. Fighters and light bombers were given the task of maintaining complete air supremacy over the waters of the Channel, so that our warships, transports and supply ships could cross in safety.

On the night before D Day, more than 10,000 tons of heavy bombs were dropped by Bomber Command on the German batteries commanding the selected landing places, with the result that they were effectively silenced.

It was expected that the Germans would make a desperate effort, in the air and on the sea, to interfere with our convoys. In fact, in both elements they did very little. They were vastly outnumbered and their Air Force was in a very serious plight. The bombed German war industries were incapable of making good its losses, its morale was very low, and it was desperately short of fuel. The Germans had, however, a considerable number of small, fast warships in the ports of Le Havre and Boulogne. Bomber Command carried out two heavy attacks on these ports soon after D Day, and sank almost every German vessel in them.

As soon as the invasion was launched, the Germans began their "V" weapon attack on this country. We had, of course, known a good deal about these weapons for some time. A very heavy surprise attack had been made on Peenemunde, the principal centre of "V" weapon research and development, and also on the numerous launching sites. The attack on Peenemunde was very successful, and the whole V weapon programme was considerably retarded.

Attacks on the launching sites compelled the Germans to abandon them and resort to a much simpler, less-efficient and more easily camouflaged form of site. The V weapon store depots were also discovered, and bombed with excellent effect. Many weapons were destroyed, and the depots were rendered unusable. In the detection of all these targets, photographic reconnaissance played an invaluable part.

These measures took the sting out of the German V.1 attack. They had planned to launch against this country an average of some 500 flying bombs a day. In fact, they averaged about 50 bombs per day, their best day being about 200. Fortunately, our fastest fighters were just able to catch the flying bombs and many were shot down before they reached their targets. A.A. guns, using new radar devices and proximity fuses, also destroyed many of them. As a result, only about one-third of the flying bombs launched by the enemy were effective.

With the failure of the V.1 flying bombs, the Germans turned to the V.2, the ballistic rocket. But the four great launching sites, protected by 15 or more feet of concrete and served by rail, from which they intended to fire large numbers of rockets, had been utterly destroyed by super-heavy bombs. In addition, many rockets were destroyed or damaged in the factories and store depots, or en route to the firing points. They were able to fire only a relatively small number of rockets from simple camouflaged sites in woods. But, unlike the flying bombs, we had no means of defence against the rockets once they had been fired, and the only way of dealing with them was to interfere with their production, transportation, and launching.

In all, our measures were very successful, and what might have been a terrible menace to London and other towns in the south was reduced to the status of a serious nuisance. But we did not put an end to the V weapon campaign until our troops had captured the launching zones.

The landings on the Normandy beaches were completely successful. Owing to the thoroughness of the air preparation, the Allied troops got ashore without serious difficulty and established sizeable beach-heads. The Germans were unable to move their divisions in the Pas de Calais and elsewhere to the threatened points, because their communications had been almost destroyed. Commenting on this the official History, Volume V, says: "... the critical importance and success of the air effort for 'Overlord' cannot indeed be overestimated." And the German commander, Field Marshal von Rundstedt, said: "... the main difficulties which arose for us at the time of the invasion were the systematic preparations by your Air Force; the smashing of the main lines of communications, particularly the railway junctions. We had prepared for various eventualities that all came to nothing or were rendered impossible by the destruction of railway communications, stations, etc."

When the Allied armies broke out of their beach-heads and began their advance, a system of using the heavy bombers in close support was successfully developed. Many enemy strong points were pulverized and their defenders so shaken and demoralized that they were easily dealt with.

Experience showed that it was most important for the Army to follow up such attacks closely, before the enemy had time to recover. Troops were, therefore, brought up very close to the bombing and great care was needed in the planning of such operations to avoid unfortunate incidents. The crumbling of the German Air Force and the disorganization of their early warning and air defence system made it possible to operate the heavy bombers in daylight which had certain advantages. No. 11 Group, Fighter Command, provided general fighter cover.

The Germans knew that we must have the use of good ports

*Given the code name "Overlord."

The Douglas Boston—the Mk. III is illustrated—was supplied to the R.A.F. under American lease/lend and eventually replaced the Blenheim for day-bombing. It first went into action early in 1942 with No. 88 Squadron. The Havoc was a night-intruder variant. Both had Pratt & Whitney Twin Wasp engines.

The Bristol Beaufighter, the first R.A.F. aircraft designed specifically for night-fighting, first went into action against the Luftwaffe over London early in 1941. Later the type served overseas on both day and night operations and as a strike and torpedo fighter. This picture shows a Beaufighter operating in Sicily in 1943.

in order to support our advance, and so they left behind considerable garrisons in Le Havre, Boulogne, and Calais, with the object of denying them to us for as long as possible. All these ports were quickly captured with very small losses after their defenders had been heavily bombed. For example, after Bomber Command had dealt with its defences, Le Havre was taken, and 11,000 German troops captured, with the loss of about 50 men on our side.

In September, 1944, an attempt was made to cross the Rhine at Nijmegen by means of an Anglo-American air-borne assault on a large scale. A whole British division was lifted and successfully dropped at the right place by aircraft of No. 38 Group. But the operation was ill-conceived, and in spite of everything we could do it failed completely. After a heroic resistance at Arnhem, with strong support from the R.A.F., most of our troops were killed or captured.

After we had taken the port of Antwerp, we were unable to use it as a German garrison on Walcheren Island commanded the approaches to the port. Heavy bombers of Bomber Command breached the dykes, flooded the defences, and the island was captured with small losses.

Finally, the Rhine was crossed at Wesel with trifling loss, after the defenders on the far bank had been crushed by a heavy bombing attack. This operation was carried out by Bomber Command in darkness, and our forward troops were less than 1,000 yards from the target.

It is worth quoting from two of a number of appreciative messages sent by Field-Marshal Montgomery to the Commander-in-Chief, Bomber Command, as the R.A.F. has been accused in some quarters of failing to give the Army the support it was entitled to expect. The first one refers to an attack on enemy strong points near Caen, carried out in order to assist the Army to advance from a very difficult position.

"Again the Allied Armies in France would like to thank you personally and Bomber Command for your magnificent co-operation last night. We know well that your main work lies further afield and we applaud your continuous and sustained bombing of German war industries and the effect this has on the German war effort. But we also know well that you are always ready to bring your mighty effort closer when such action is really needed and to co-operate in our tactical battle. When you do this your action is always decisive."

And again, after the crossing of the Rhine:

"My grateful appreciation for the quite magnificent co-operation you have given us in the Battle of the Rhine. The bombing of Wesel last night was a masterpiece and was a decisive factor in making possible our entry into that town before midnight."

It is worth remembering that Field-Marshal Montgomery always chooses his words carefully.

In the Mediterranean theatre, we continued to advance up the "leg" of Italy, but the country was ideal for defence and our progress was slow. We attempted to hasten our advance by making sea-borne assaults at Salerno and Anzio with strong air support. Italy surrendered in September, 1943, but the Germans continued to resist our advance. We entered Naples in October, 1943, Rome fell in June, 1944, and we took Leghorn in the following month.

American long-range bombers were moved forward with the idea of attacking Germany from the south, but poor weather conditions and other difficulties prevented them from making any significant contribution to the strategic bombardment of Germany.

With the invasion safely under way in Europe, Bomber Command returned, apart from periodic operations in support of the Army, to the strategic offensive against Germany. When the Germans lost the Rumanian oilfields, the attack on their synthetic oil plants became worthwhile. These were the main targets for Bomber Command's renewed offensive. With general fighter cover daylight attacks were made on the smaller installations in the Ruhr, while the main plants, such as Leuna and Brux, were attacked by night.

Our radar navigation and blind-bombing control stations had been moved to the Continent, and placed as far forward as the military situation allowed, thereby greatly increasing the accuracy of our attacks. The German Air Force was so broken, and their air defence system so disorganized, that the aircraft of Bomber Command could go where they liked with hardly any losses, and could deliver the heaviest blows at any target within range.

So successful were these attacks that by the late autumn of 1944 the Germans were desperately short of all types of oil fuel, especially aircraft fuel. By the time that Germany surrendered, in May, 1945, her industry was so crippled by bombing that, for several years after the end of the War in Europe, it was incapable of meeting her minimum peace-time needs.

The Fairey Swordfish was designed primarily as a fleet torpedo bomber for the F.A.A., but also served for a long period with R.A.F. Coastal Command for night anti-shipping strikes, laden, as illustrated here, with radar, bombs and external fuel.

It will be fitting to conclude by summarizing briefly the principal activities and achievements of the Royal Air Force during the War.

After our initial defeat and the fall of France, Fighter and Bomber Commands successfully beat off the German attacks on this country and shattered their preparations for invasion. They thus saw us safely through the opening defensive phase of the War. Thereafter they allowed us to develop and expand our war industries, secure from air attack.

After the Battle of Britain, and the failure of the German night bombing campaign against our industrial cities which followed it, Fighter Command had little to do, and its strength was gradually reduced as aircraft and pilots were drawn off into the Tactical Air Forces—in the Mediterranean, Burma-Malaya, and European theatres of war. When the Germans began their V-weapon assault on this country, Fighter Command had another period of intense activity and was successful in destroying many flying bombs.

In the war at sea Coastal Command took a very successful and ever growing part in the unending struggle against the German U-boats—the Battle of the Atlantic, as it has been

called. Of the total number of U-boats sunk from known cause, 41% were destroyed by land-based aircraft, including losses caused by air-laid mines. Bomber Command sank, or put out of action, the majority of the larger German warships. In addition, the Command laid nearly 50,000 sea mines and, by mining and direct attack, sank a total of nearly 600 German ships. Several hundred more were damaged, more or less severely.

The Tactical Air Forces, using rockets, guns and bombs, in the Mediterranean, Europe and Far East, gave closely integrated support to our armies.

Bomber Command's strategic bombing campaign, in close co-operation with the United States 8th Air Force, smashed the German war industries, crippled their communications, retarded their production of U-boats, reduced their supplies of oil fuel, undermined their civilian morale, and was a major factor in bringing about the German withdrawal from Russia. This campaign, and the resulting collapse of the German Air Force, created the conditions which made invasion of the Continent possible.

Air Forces ensured the success of the invasion itself by the destruction of the enemy's communications and coast defences, and by maintaining complete air supremacy over the Channel and the beach-heads.

Bomber and Fighter Commands defeated the Germans' last hope, their V-weapons, and averted what might have been catastrophic destruction and loss of life in London and other southern towns.

An attempt was made after the War to assess the effect of the bombing campaign by estimating the loss of production in certain key German industries. On the face of it, this survey produced disappointing results. The value of such an estimate is, however, very doubtful. It is difficult, often impossible, to discover what were the German requirements or their planned production figures. Unless we know that, we cannot estimate by how much they fell short of them.

The following example will serve to illustrate the point. Suppose that our own monthly production of aircraft in 1940 was 250, mostly small types such as fighters and light bombers. By 1945 it was, let us suppose, 1,000, consisting of a large proportion of four-engined heavy bombers, improved fighters and fighter-bombers.

Now let us imagine that the Germans had bombed us on a heavy scale from 1940 to 1945. Our production in 1945 might then have been, say, 500 a month, mostly fighters used in our own defence. It would, nevertheless, be true to say that, in spite of the bombing, our production of aircraft had increased since 1940 by 100%, and of fighters by perhaps as much as 200%. It would be true to say that, but it would be most misleading. It would be more accurate to say that, after this hypothetical bombing, we possessed in 1945, not the powerful well-balanced air force which, indeed, we had, but a purely defensive force quite inadequate for our needs.

So it was with Germany. Although it is true that, in spite of our bombing, they were producing more aircraft and certainly more fighters than in 1940, their air force by 1944 was hopelessly inadequate and capable only of an unsuccessful attempt to defend their homeland. Their armies in the field were allotted less than a quarter of their total air forces, and everywhere had to fight under conditions of air inferiority. With the failure of their air power they lost the initiative and were everywhere thrown on the defensive.

We know from captured German documents that, by the end of 1943, they were seriously short of aircraft, tanks, guns, ammunition, locomotives, rolling stock, motor transport, oil fuel and clothing. Although short of manpower, they were forced to allocate nearly a million men to passive air defence and repair work. The general weakening of German military power was the direct result of shortages of all kinds due to the strategic bombing.

Few people realize the weight of attack involved in the strategic bombing campaign against Germany. The total weight of bombs, including flying bombs and rockets, dropped on this country by Germany during the War was about 72,000 tons. Bomber Command dropped just short of a million tons, of which some 600,000 tons were on targets in Germany. In addition, the United States 8th Air Force dropped roughly as much again, with a slightly higher percentage on Germany. The total weight, therefore, of bombs on Germany was approximately 18 times as much as that dropped on this country and the accuracy of the Allied bombing attacks was, of course, far greater than that achieved by the enemy.

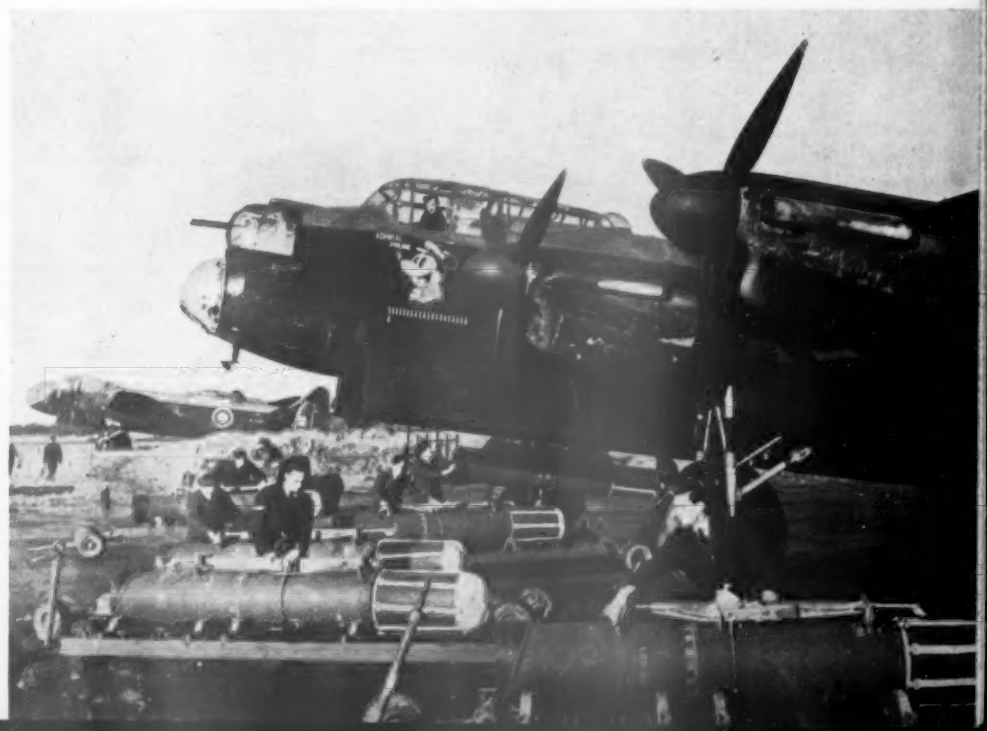
The dramatic success of the Royal Air Force in the last war was largely due to the Air Ministry's policy of submitting its problems, in good time, to panels of distinguished scientists. It also owed much to the establishment, in all Commands, of Operational Research Sections staffed by scientists. These Sections watched and analysed operations, made suggestions and recommendations, and were of the greatest possible help to those responsible for the conduct of operations.

From this brief summary it can be seen that air power, in 1945, had reached its full stature. In a little over 30 years military aircraft had evolved from an unarmed reconnaissance vehicle to the supreme offensive weapon of the age.

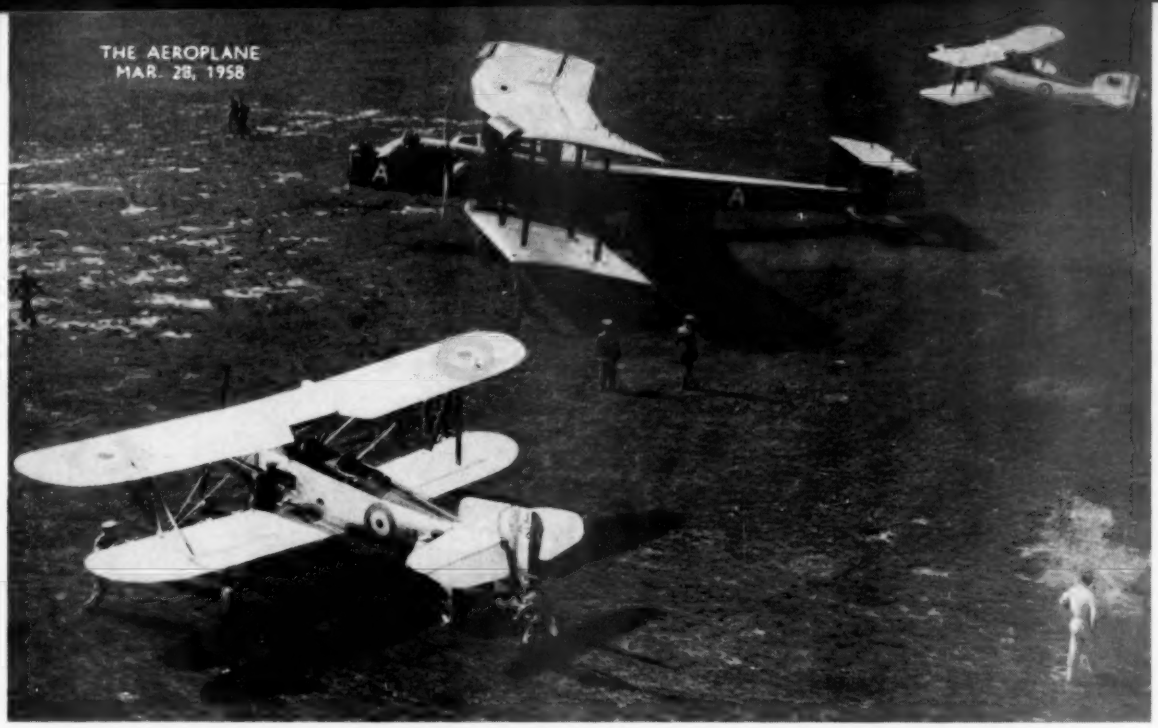
Some indication of the extent to which the Royal Air Force bore the brunt of the fighting is given by the following figures. In the First World War approximately one airman was killed for every 100 soldiers. In the Second World War the comparable figure was 70 airmen for every 100 soldiers.

The War not only proved that aircraft possess tremendous offensive power, but it showed that in all operations on land and sea, mastery of the air was a prerequisite of success. In the whole history of the War, in every campaign in all parts of the world, this rule held good, and there was no exception to it.

Sir Winston Churchill, speaking at Boston, Massachusetts, in 1949, summed up the position with force and clarity when he said: "For good or ill, air mastery is today the supreme expression of military power, and fleets and armies, however necessary, must accept a subordinate rank."



The Avro Lancaster, with the Handley Page Halifax, formed the mainstay of R.A.F. Bomber Command for several years of the War. The Lancaster—7,366 of all versions were built in the United Kingdom and in Canada—carried the 22,000-lb. "Grand Slam" bomb and altogether flew 156,000 sorties. In this picture a Lancaster is being prepared for mine-laying operations. In the background is an Avro Manchester I, predecessor of the Lancaster.



Three widely used R.A.F. aircraft between the Wars were the Fairey Fox day-bomber, the Vickers Virginia heavy night-bomber and the Fairey Gordon general-purpose aircraft.

The R.A.F. Between the Wars

In the years between 1919 *and* 1939 *no member of the editorial staff of* THE AEROPLANE *devoted more time to the study of the Royal Air Force than did the late* MRS. C. M. MCALERY, *who retired from the W.A.A.F. in* 1946 *with the rank of Group Officer and by whom this hitherto unpublished survey was written.*

THERE is to this day some diversity of opinion as to whether the 1914-18 War was a good or a bad thing for aviation. Undoubtedly it speeded up the development of all types of aircraft to an extent that is unimaginable in peace-time, but this largely artificial acceleration prevented progress in economic efficiency.

The growth of the flying services in the four years of war was tremendous. On the outbreak of war there were 276 officers and 1,797 other ranks in the British Air Services. The R.F.C. had 179 aeroplanes and the R.N.A.S. had 91 seaplanes and aeroplanes. At the time of the Armistice there were in the R.A.F. 27,333 officers and 263,837 other ranks. At the end of November, 1918, there were 99 squadrons and seven flights on the Western Front; 14 squadrons and one flight in the Middle East and India; four squadrons in Italy; 16 squadrons and seven flights in the Mediterranean area; and 55 operational squadrons and 56 Training Depôt squadrons at home. There were 274 stations abroad and 401 at home.

Demobilization began immediately the War was over and by the beginning of January, 1920, over 274,000 men had been released. Rebuilding had begun in August, 1919, when the first permanent commissions were gazetted to 1,065 officers.

When the new rank titles were announced they were received with considerable criticism not only by those who would have to carry them but also by members of the other Services. Civilians were completely bewildered by them and it was 20 years before they were admitted to general use. But the shock of the rank titles was nothing to the horror of the new uniforms.

The first, in an attempt to blend the Army and Navy, was a khaki uniform with a cloth belt, gilt buttons of naval type and a khaki cap with a black mohair band. With this a black tie was worn and rank was shown by braid on the cuffs and, for a few awful weeks, by vertical brass bars on the caps. Officers from both Services tried to avoid it by wearing their old uniforms long after they had become threadbare, and this gave the new Service the reputation for being slovenly.

The next uniform was of a light blue and with gilt buttons and gold lace on the cuffs. It showed every mark and was garish and impractical. It was soon abandoned. By a process of trial and error the present uniform was evolved, but changes were many and frequent and for many years it was scarcely possible to see more than a few R.A.F. officers dressed alike.

Plans for the permanent organization of the Royal Air Force, in the form of a Memorandum by the Chief of the Air Staff, were submitted to Parliament by Mr. Winston Churchill, then Secretary of State for War and Air, in December, 1919. In it Sir Hugh Trenchard stressed the need for the creation of an Air Force spirit and recommended the preservation of the famous squadrons, the creation of an Air Force Cadet College and an Air Staff College, and the recruiting and training of boys in the skilled trades to provide the mechanics of the future.

The Memorandum planned eight squadrons for India; seven for Egypt; three for Mesopotamia; and flights of seaplanes for Malta, Alexandria and the carriers in the Mediterranean. At home a small striking force of two squadrons was to be increased immediately to four, and small units were to be provided for co-operation with the Army and Navy. Fifty per cent. of the officers were to be on a short service basis and some were to be seconded from the other Services. The R.A.F. Cadet College would provide a two years' course for the Regular officers of the future.

That part of the plan which was to have the greatest effect on the Service concerned the training of aircraft apprentices. These boys have through the years provided the skilled tradesmen and technical officers of all branches on whom the maintenance of the highly complicated equipment of the Service depends.

At the end of 1919 the Women's Royal Air Force was disbanded. Formed in April, 1918, at the same time as the R.A.F., it reached a strength of about 32,000 all ranks. The airwomen were employed on nearly all ground duties and made a name for themselves for a high standard of discipline and efficiency. After the Armistice they alone of the Women's Services were chosen to go to Germany with the Occupation Forces.

At the end of 1919 all former naval elements, including airships, were placed in Coastal Command, but this did not settle the question of the Navy and the air. The Navy never

R.A.F. 40th Anniversary . . . .

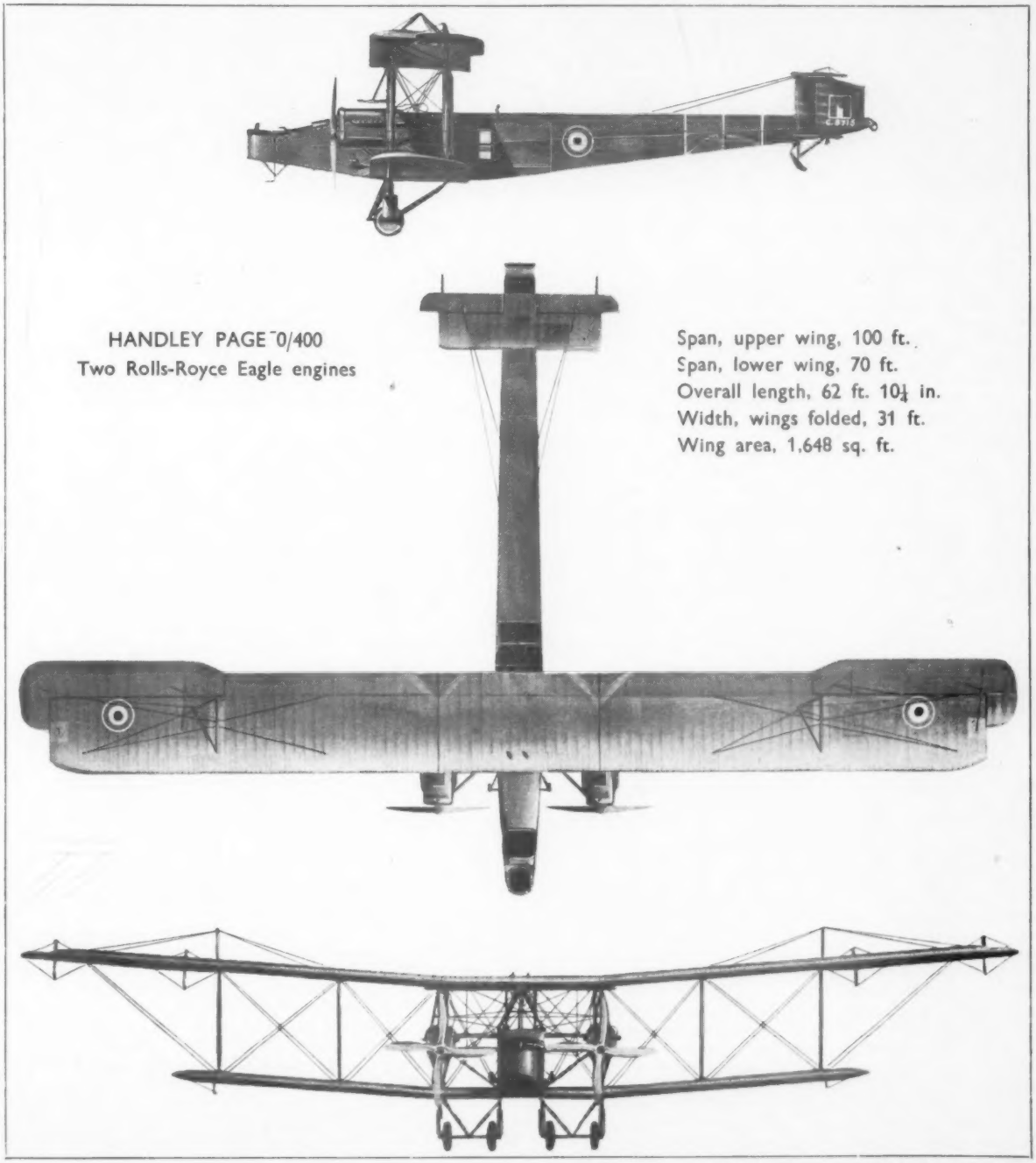
abandoned its claims on all sea-going aircraft. The builders of the Royal Air Force realized that if they agreed to relinquish any part of the new Service it would gradually disintegrate. Theirs was a hard battle, with all the political influence on the side of the Admiralty. At first the flying units in the aircraft carriers belonged to the R.A.F., with a proportion of naval officer aircrews attached to the R.A.F., but in 1924 the carrierborne units became the Fleet Air Arm although still with some R.A.F. aircrew and R.A.F. mechanics to do the maintenance work.

The Admiralty then declared they would make no further claims but, like others who have made similar declarations, this did not prevent them from intermittent endeavours to acquire Coastal Command for administration as well as operationally. In 1937 all shipborne aircraft came under the full control of the Navy and an Air Branch of the Admiralty was formed.

Apart from Coastal Command, the R.A.F. at Home was organized as Inland Area. In March, 1920, the R.A.F. had 20 squadrons and a further eight forming. The first Air Estimates provided for 3,280 officers and 25,000 other ranks at an annual cost of about £15 million.

1920 was also the first year of the Royal Air Force Display, first known as the Tournament, an annual display of the work and training of the Service. It drew enormous crowds and provided large sums for the Memorial Fund, now the R.A.F. Benevolent Fund.

Mr. Churchill relinquished his appointment as Secretary of



HANDLEY PAGE O/400
Two Rolls-Royce Eagle engines

Span, upper wing, 100 ft.
Span, lower wing, 70 ft.
Overall length, 62 ft. 10¼ in.
Width, wings folded, 31 ft.
Wing area, 1,648 sq. ft.

"The Aeroplane" copyright drawing by Roy Cross

Recent photographs in THE AEROPLANE of Miran Shah on the N.W. Frontier region of Pakistan brought to light, from the collection of Air Chief Marshal Sir John Baker, who served in the area in the 1920's, this picture of the fort when the D.H. 9As of No. 60 Squadron were on detachment, in the winter of 1926.

State for War and Air in February, 1921, and was succeeded at the Air Ministry by Capt. the Hon. F. E. Guest. In March, 1922, Mr. Austen Chamberlain announced that in defence against air raids the R.A.F. was to be primarily responsible, and in August, 1923, the Government's decision to raise 15 new squadrons for Home Defence was announced. In the early part of that year there had been only 35 squadrons in the whole R.A.F., but air defence suddenly assumed a new importance and a Committee was set up under the chairmanship of the Marquess of Salisbury to inquire into it. The Salisbury Committee recommended a Home Defence force of 52 squadrons.

In 1925 the Air Defence of Great Britain came into being as a unified command under Air Marshal Sir John Salmond, and included fighters, bombers, anti-aircraft units and Observer Posts. This was also the year of the formation of the Auxiliary Air Force. The new Command was organized into Wessex Bombing Area, Fighting Area and No. 1 Air Defence Group which included the Auxiliary and Reserve units. The first Exercises of the Command took place in 1927 and 19 squadrons took part.

For co-operation in air matters with the other Services, control was vested in the Service concerned, but design, provision and elementary training remained with the R.A.F.

Sir Hugh Trenchard resigned at the end of 1929 after 11 years as Chief of the Air Staff and was succeeded by Air Marshal Sir John Salmond.

Opening Up the Air Routes

The Royal Air Force played an important part in the survey and development of Empire Air Routes, while at the same time their squadrons guarded the strategic points of these routes. The first link in these routes was forged by the survey of a route from Damascus to Baghdad. After some preliminary attempts a track which could be followed from the air was marked across the desert by a car convoy with air co-operation. The car tracks made a successful temporary route, and the following year the route was ploughed and landing grounds were marked with a ploughed circle and a number. The car parties were supplied entirely by air and the pioneer convoy was accompanied by D.H.9s of 47 and 30 Squadrons and a Handley Page of 70 Squadron.

In June, 1921, the air route from Cairo to Baghdad was opened by aircraft of 47 Squadron and soon after an official air mail service was inaugurated which was run by the R.A.F. until 1927, when Imperial Airways took it over. The job was shared by 216, 45 and 70 Squadrons.

A series of long-distance flights, some of which were connected with the survey of air routes, began in 1925 and went on until 1939. These gave experience and training to the R.A.F., and demonstrated to the World the reliability of British aircraft. The first important one was a cruise of 2,500 miles round the British Isles by four flying-boats from Calshot.

In October, 1925, a flight of three D.H.9As flew from Cairo to Kano and back. Early in 1926 four Fairey IIIDs flew from Cairo to the Cape and back. Flights between Cairo and the Cape became a regular training exercise.

Cruises were also made by flying-boats in the Baltic and the Mediterranean. In 1927, four Supermarine Southampton flying-boats made a cruise of 23,000 miles before taking up station at Singapore, and soon after arriving there they flew round Australia and to Japan.

The Royal Air Force also took part in competitive flying. In 1927, a British team, consisting of Service personnel trained in the High Speed Flight at Felixstowe, competed for and won the Schneider Trophy. Two years later they won it for the second time, and immediately after put up a new World's Speed Record. In 1931 the High Speed Flight won the Trophy outright and raised the speed record to 407.5 m.p.h. The R.A.F. also attacked the Long Distance Record, which they broke in 1931 with a flight of 5,340 miles.

A number of small wars in which the Royal Air Force played a prominent part took place in the years between the end of the War in 1918 and the outbreak of the greater struggle of 1939. Operations in Russia, which began in June, 1918, after the peace treaty between Germany and Russia had been signed, went on until the end of 1919.

The North Russian Expeditionary Force included a flight of D.H.4s, and in July, 1918, they were joined by the seaplane carrier "Niarana" with a complement of seaplanes and a fighter. They remained at Archangel and Murmansk during the operations. When the Dardenelles was opened after the Armistice, a squadron went to the Aegean, thence to Baku and Petrovsk. The training mission which went to South Russia in April, 1919, was followed by a detachment from 47 Squadron, and in June of that year a flight of Short seaplanes went to Archangel followed by the carrier "Pegasus" and later the "Argus" with reinforcements.

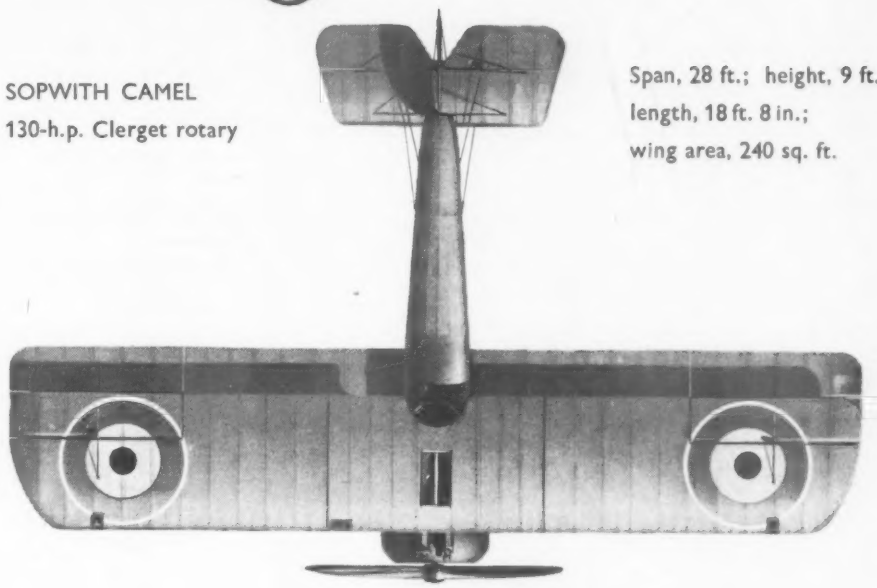
These Royal Air Force detachments did some very good work in most trying conditions until, at the end of 1919, they were evacuated from North Russia to concentrate on South Russia, where they remained until the middle of 1920. Outstanding work was done in South Russia by a flight of Sopwith Camels of 47 Sqn., led by Capt. S. M. Kinkead, who later lost his life in a test flight in the Schneider Trophy contest.

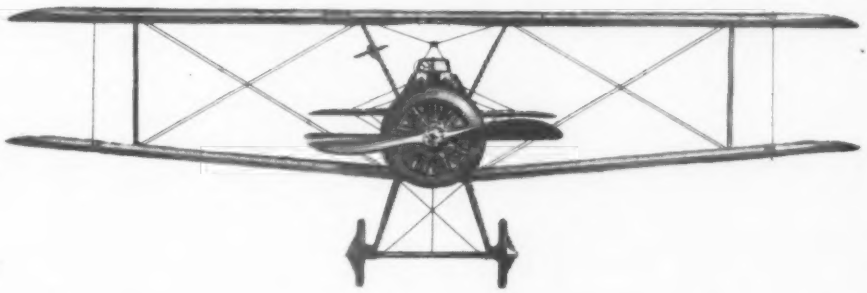
Operations in Anatolia were supported by "Q" Force, R.A.F., consisting of a Wing H.Q., No. 55 Squadron and an aircraft park, which went in the "Ark Royal" from Alexandria to Constantinople. At the same time, the "Pegasus" went to co-operate with the Army of the Black Sea in the defence of

(*Continued on page* 451)

SOPWITH CAMEL
130-h.p. Clerget rotary

Span, 28 ft.; height, 9 ft.;
length, 18 ft. 8 in.;
wing area, 240 sq. ft.





"The Aeroplane" copyright drawing by Roy Cross

(*Continued from page* 450)

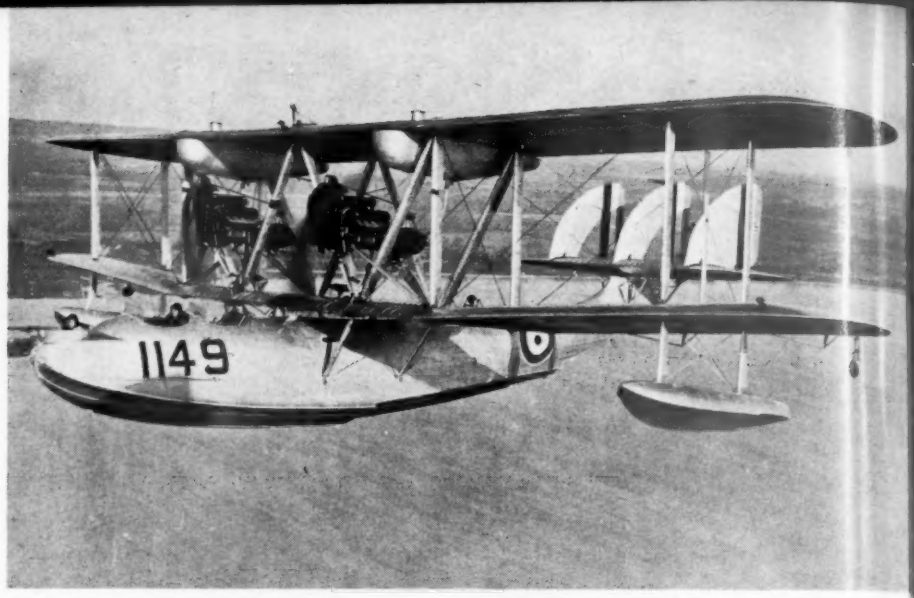
the Dardanelles and Constantinople against the Turkish Nationalist forces. After working with other Naval vessels in the Gulf of Ismid, it operated along the northern coast of Anatolia to Batum and returned to Constantinople in October, 1920.

The Third Afghan War broke out in 1919. The R.A.F. made several bombing attacks on military targets and did close reconnaissance patrols for the Army. A raid in which Lt. R. Halley bombed Kabul with a Handley Page V/1500 was said to have been an important factor in producing a desire for peace at Headquarters of the Afghan Government. Peace with the Afghans was followed immediately by an outbreak in Waziristan, and in these operations aeroplanes were used to an increasing extent but with little bombing.

In 1925 the Government of India agreed to a trial of independent air action on the North-West Frontier, and in less than two months the R.A.F. had brought the tribes to submission with only two casualties. Inter-tribal disorders in Afghanistan at the end of 1928 and the beginning of 1929 gave the R.A.F. a good opportunity for further service and made history.

The Shiamwari tribe had rebelled against King Amanullah, invested Dakka and cut road and telegraph communications between Kabul and the Khyber Pass. The British Legation at Kabul was cut off and the British Commissioner asked that women and children should, if possible, be evacuated. Between December 23, 1928, and February 25, 1929, 586 people of all nationalities were flown out of Kabul. The R.A.F. flew 28,160 miles on this duty, or 57,438 including journeys from Iraq and Risalpur with aircraft reinforcements. They flew over mountains, averaging 10,000 ft., in one of the severest winters on record.

At the time of the Nationalist risings in Egypt in 1919, there were no Service squadrons in the country, so three special units "X," "Y" and "Z" squadrons were formed from personnel awaiting demobilization in the Training Brigade. These squadrons maintained a postal service between Alexandria,



Flying-boats have long formed an important part of the R.A.F.'s equipment. Supermarine Southamptons such as this, for example, completed some notable long-distance flights in the 1920s.

Cairo, Ismailia, Port Said and Suez, patrolled the railways and co-operated with the ground forces.

An air contingent, known as "H" unit, joined in a punitive expedition against the Garjak Nuers in South-Eastern Sudan in 1920 when, after four weeks, with bombing and machine-gunning, the native chiefs sued for peace. In July, 1922, a flight of 14 Squadron co-operated with "Peake's Force" of the Transjordan Army to bring the Kura district under submission to the Government. The aircraft operated from Amman and after two days' intensive bombing, the ground forces were able to occupy the affected area.

The first occasion on which the R.A.F. operated in a primary role was in Somaliland in 1920. A small force known as the "Z" Expedition consisting of 12 D.H.9. aeroplanes, 36 officers and 183 airmen and with some mechanical transport and 800 tons of supplies was embarked in the "Ark Royal." On arrival in Somaliland it was joined by the local Field force, and in three weeks operations cleared up disaffection and rebellion caused by the notorious "Mad Mullah" who had defied the administration for 25 years. This was also the first campaign in which aeroplanes were used to evacuate battle casualties.

When British interests in the Dardanelles zone were threatened by Turkish nationalists in 1922, air reinforcements were sent there from the United Kingdom consisting of a Wing headquarters and three squadrons. One squadron, No. 4, arrived in Killia Bay in the "Ark Royal" and, as there were no landing facilities, its Bristol Fighters were transferred to the "Argus" and flown off. The force became the Constantinople Wing and remained there until the end of August.

A decision of great importance, which was to affect the whole future of the Royal Air Force overseas, was made at a conference held in Cairo in 1921 to examine the position of the mandated territories in the Middle East. The conference was attended by the Chief of the Air Staff and the decision was taken to place the control of Mesopotamia under the Royal Air Force. They were to have eight squadrons there and the Imperial military garrison was to be reduced to four Infantry Battalions, one Indian Pack Battery and three armoured companies.

Squadrons that were already in the country were Nos. 8, 30, 55 and 84, all with D.H.9As and Nos. 45 and 70 were transferred with their Vernons from Egypt.

Finally, No. 1 Squadron with Snipes was brought from India. Control was taken over in October, 1922. At the time Turkish troops were concentrated on the frontier and some of their irregular forces had penetrated the border in the Mosul area. They had also occupied Rowanduz and established a post within 40 miles of Kirkuk.

Air action followed an ultimatum dropped from the air and the Turks were driven out. During the operations, stores and spares were flown from Hinaidi to Kirkuk, rations were delivered by air to the mobile columns, and 200 cases of sickness were evacuated to Baghdad, thus avoiding a six days journey by donkey. Operations against the Turks continued intermittently until the autumn of 1924, when a provisional boundary was established by the League of Nations.

But the Turks were not the only trouble-makers for the new controlling force. Sheikh Mahmud, a former Governor of Sulaimanya and Southern Kurdistan, who had led an armed revolt against the administration and had been captured and interned in India, was released and reinstated in 1922. Within a few months he was found to be plotting an insurrection backed by the Turks. He was summoned to Baghdad, refused to obey and received an ultimatum. A few delay-action bombs were dropped on his Headquarters and he escaped to the hills.

The plot for a general uprising was discovered and a combined ground air operation had to be organized. Royal Air Force units were moved into Mosul, Kirkuk and Erbil; two columns were formed and advanced North. After some fighting, Rowanduz was occupied and the Turkish element in the rising driven over the border. Sulaimanya was occupied on May 17, and Mahmud and his followers crossed the border into Persia.

Later that year he returned and proclaimed himself King of Kurdistan but was again driven out when his house in Sulaimanya was bombed and destroyed. This rather endearing old rascal came to be known as the R.A.F. Director of Training because his activities kept the force in Iraq occupied and on the alert over a number of years.

There was also some trouble around Diwaniyah about the latter part of 1923 and this was effectively stopped by bombing. The country also suffered from raiding tribes who preyed on the more stable and prosperous members of the community. In 1920 the Akhwan tribes from Najd raided over the frontier into South Iraq, and aircraft patrols along the border helped to establish confidence and reassure the peaceful tribesmen.

A year or two later some more severe raids had to be dealt with by air action. In October, 1926, a large raid into Kuwait was intercepted on its return by aircraft and armoured cars and further action later in the year resulted in a treaty being signed between Iraq and the Najd. This treaty was ineffective and raiding with counter air operations continued until 1928.

Further disorders continued in different parts of the country during practically the whole of the British occupation and had the usual methods of ground control been used, there would undoubtedly have been great loss of life and heavy expenditure. When the situation required a small force of troops or police they were flown quickly to the scene.

Sheikh Mahmud became active again in the summer of 1924 when he declared a Holy War against the British. The Government decided to put a final end to his activities and a force of 42 aircraft were assembled. When, after the usual ultimatums he refused to surrender, his forces at Sulaimanya were subjected to 48 hours of non-stop bombing in the course of which 28 tons of bombs were dropped. The town was then occupied by the ground forces. Warned in time the inhabitants had cleared out into the hills and there were no casualties among them.

Mahmud lay up during the winter and the following spring rallied his followers once more. Several actions were fought and in one of them a flight of No. 1 Squadron dispersed a large body of tribesmen caught in the open. Again Mahmud retired to Persia for the winter and, on returning in the spring, he managed to evade all efforts to round him up.

There was some severe fighting in the summer of 1926; when

he crossed the border into Persia again, he took with him the pilot and air gunner of an aeroplane of No. 30 Squadron as prisoners. They were well treated but fell ill and he allowed a British Army doctor to visit them. Later he handed them over. In 1927 he came in and submitted to the Government.

Another destroyer of peace was Sheikh Ahmed of Barzan, and in 1927 his territory had to be occupied by Iraq Levies after some fighting in which Nos. 6 and 55 Squadrons took part.

The Royal Air Force began to hand over its responsibilities in 1930, when Iraq became an independent State and it was then Sheikh Mahmud came out of retirement and made his final bid. The new Iraq Army went into action backed by some units of the R.A.F. and by May, 1931, the rebel forces were broken up and Mahmud again a captive.

The Iraq Government then tried to tackle the Barzan district, this time using the new Iraq Air Force. But a column of the Army got into difficulties and the R.A.F. had to intervene, engage the enemy and drop supplies to the ground forces. The R.A.F. then took over the operations and after warnings dropped from aeroplanes and broadcast in Kurdish by loud-speakers fitted in the aircraft, the striking force went in with light bombs. The Sheikh and his followers retired to their caves but were driven out and finally crossed the border into Turkey where they surrendered.

As a result of the success of air control in Iraq, the experiment was extended to Aden in 1928 when the Protectorate, then in some state of disorder, was placed under the command of a Royal Air Force officer. No. 8 (Bomber) Squadron was sent there and an armoured car section and a small unit of native Levies raised. Air action was taken against the Imam of Yemen who had crossed the border from his own country and seized Dhala. He retired into his own country.

Another tribe, the Subelhis, came raiding into the fertile Lahej country in 1929, and they also had to be suppressed. In 1934 a party of Quetebis held and robbed a caravan and their leader refused to surrender the criminals or pay for the loot. Air action in this instance consisted of a blockade whereby they were cut off from their villages and grazing grounds by delay-action bombs. In two months they came in and surrendered.

In April, 1927, No. 2 Squadron was sent to China to supplement the unit in H.M.S. "Hermes" and in support of the Shanghai Volunteer Force. They became, with other Naval units, the China Command, but were disbanded after a short time when the threat to peace and security was removed.

The programme of expansion of the Royal Air Force, which had been laid down in 1923, was still incomplete ten years later, partly because of national economy and partly because of the general effort towards the limitation of armaments At the end of 1933 the Royal Air Force had only 74 squadrons, including 13 Reserve and Auxiliary squadrons and the units of the Fleet Air Arm. Failure to reach agreement about disarmament at Geneva in 1934 compelled the British Government to increase the Air Force. The Air Estimates that year made provision for only six new squadrons, but in view of the general feeling of concern and anxiety throughout the country, a new programme was announced in July to bring the first line up to 128 squadrons in five years. This was again accelerated in November by the decision to form 22 Home Defence squadrons and three more for the Fleet Air Arm in 1935-36.

When Germany disclosed the existence of her Air Force in 1936 and her determination to begin conscription, the British Government announced yet another expansion of the Air Force. By March, 1937, it was to have 1,500 first-line aircraft irrespective of the Fleet Air Arm. This meant forming 71 new squadrons in 1935-36 and called for a general expansion of training and all other services. The Air Defence of Great Britain Command ceased to exist in July, 1936, and Home Defence was reorganized into Bomber, Fighter, Coastal and Training Commands. On July 6, 1935, His Majesty King George V held a Review of the Royal Air Force as part of the Royal Jubilee celebrations. It was in two parts, a ground inspection at Mildenhall followed by a fly-past at Duxford of 350 aircraft.

The first years of the expansion were beset with difficulties. In 1935 reinforcements amounting to some twenty-four squadrons had to be sent to Malta, Gibraltar, Egypt and Aden to deal with the international situation which had arisen from the occupation of Abyssinia by Italy. This was followed immediately by the formation of a flying-boat wing in the Mediterranean as part of the Nyon patrol in connection with the Spanish Civil War. At the same time, the administration and training of the Fleet Air Arm was being handed over to the Navy.

These extra commitments came at the same time that the Air Force was being increased to three times its previous strength, taking over quantities of new equipment and new stations, and dealing with revolutionary designs in aircraft and armament. The great variety of types of aircraft then in service made maintenance difficult.

For training, there were three Avros and the Tiger Moth. There were three general purpose aircraft: the Wapiti, the Hardy and the Vincent; five day bombers, the Hart, the Hind, the Wallace, the Gordon and the Overstrand; three for army co-operation, the Hector, the Audax and the Wapiti; and five fighters, the Demon, the Bulldog, the Fury, the Gauntlet and the Gladiator.

There were also the general reconnaissance Anson, the Valentia troop-carrier and four night bombers, the Virginia, the Hinaidi, the Heyford and the Hendon. For Coastal reconnaissance there were seven flying-boats, the Southampton, the Scapa, the Stranraer, the London, the Perth, the Singapore and the Cloud, and for coast defence the Vildebeest.

The Fleet had, for reconnaissance, the Fairey IIIF, the Seal and the Shark; for torpedoes, the Ripon, the Baffin and the Swordfish; as a fighter, the Nimrod, and for fighter reconnaissance, the Osprey.

By 1938 there were a number of new and improved types. The Anson, the Hart and the Hind had been adapted as trainers and there was also the Magister, the Oxford and the Prefect. To the bombers had been added the Battle, the Blenheim, the Hampden, the Hereford, the Harrow, the Wellington and the Whitley, and for transport the Bombay. Army Co-operation had the Lysander, and, for general purposes, the Wellesley was added. The new fighters were the Hurricane and the Spitfire, and, for communications, the de Havilland 86B, Dragon Rapide and Don, and the Mentor and the Vega Gull. The Fleet had the Walrus amphibian, the Seafox and the Skua.

Bristol Bulldogs preceded the Gauntlets of the mid-'30s. They were used as single-seat day and night fighters and first went into service in 1929.

R.A.F. AIRCRAFT OVER FOUR DECADES

These tables, compiled by JOHN W. R. TAYLOR, *give details of 200 of the most important types of aircraft that have served with the Royal Air Force since April, 1918. Types built specifically for the Fleet Air Arm since this Service became a separate entity in 1924 are excluded. In most cases only one mark of each type is described; but the list of squadrons in the final column covers every mark of that particular aircraft.*

Aircraft	Duty	Crew	Powerplant	Span	Gross weight	Max. speed	Military load	Squadrons ‡
Airspeed				ft. in.	lb.	m.p.h.		
Oxford II	A.T.	3	2×355-h.p. Cheetah X	53 4	7,600	188	—	285, 286, 289, 290, 567, 577, 598, 631, 667, 691.
Armstrong Whitworth								
Albemarle VI	Tp./G.T.	4	2×1,590-h.p. Hercules XI	77 0	36,500	265	Tp. 10 pass., 2 m/g.	161, 295, 296, 297, 511, 570.
Atlas	A.C.	2	1×450-h.p. Jaguar IVC	39 6	4,020	143.5	4×112-lb. bombs, 2 m/g.	2, 4, 13, 16, 26, 208.
F.K.8	R.	2	1×160-h.p. Beardmore	43 6	2,811	98.4	2 m/g.	2, 8, 10, 17, 35, 47, 82, 142.
Meteor NF.14	N.F.	2	2×3,600-lb. s.t. Derwent 9	43 0	*20,000*	*580*	4 c/g.	(Mks. 11–14) 25, 29, 39, 46, 64, 68, 72, 85, 87, 96, 125, 152, 153, 219, 256, 264,
Siskin IIIA	F.	1	1×450-h.p. Jaguar IVS	33 2	3,040	166.5	2 m/g., 4×20-lb. bombs	1, 17, 19, 25, 29, 32, 41, 43, 54, 56, 111.
Whitley I	N.B.	5	2×980-h.p. Tiger IX	84 0	23,300	192	3,000 lb. bombs for 1,650 m., 4 m/g.	7, 10, 51, 58, 76, 77, 78, 97, 102, 103, 138, 161, 166, 295, 296, 299, 502, 612.
Auster								
AOP.6	A.O.P.	2	1×145-h.p. Gipsy Major 7	36 0	2,160	124	—	651, 652, 656, 657, 661, 662, 663, 664, 666.
Avro								
504K	P.T.	2	1×100-h.p. Gnôme	36 0	1,800	82	—	
Aldershot	B.	3	1×650-h.p. Condor III	68 0	10,950	110	2,000 lb. bombs, 1 m/g.	24, 600, 601, 602, 603.
Anson I	C.R.	3	2×350-h.p. Cheetah IX	56 6	8,000	188	200 lb. bombs, 4 m/g.	99.
Anson T.21	N.T.	6	2×420-h.p. Cheetah 15 or 17	57 6	10,306	171	—	7, 24, 31, 35, 44, 48, 51, 58, 61, 76, 78, 116, 144, 147, 148, 167, 187, 206, 217, 220, 221, 224, 233, 269, 275, 276, 278, 279, 280, 281, 282, 320, 321, 437, 500, 502, 510, 512, 516, 527, 544, 575, 608, 612.
Lancaster I	N.B.	7	4×1,280-h.p. Merlin 20	102 0	68,000	270	14,000 lb. bombs for 1,660 m., 9 m/g.	
Lincoln B.1	N.B.	7	4×1,750-h.p. Merlin 85	120 0	82,000	310	14,000 lb. bombs for 2,640 m., 6 m/g.	7, 9, 12, 15, 35, 37, 38, 40, 44, 49, 50, 57, 61, 75, 82, 83, 90, 97, 100, 101, 103, 104, 106, 109, 115, 120, 138, 148, 149, 150, 153, 156, 166, 170, 186, 189, 195, 203, 207, 210, 214, 218, 224, 227, 300, 405, 408, 419, 420, 424, 426, 427, 428, 429, 431, 432, 433, 434, 460, 463, 467, 514, 550, 576, 582, 617, 619, 622, 625, 626, 630, 635.
Manchester 1	N.B.	7	2×1,760-h.p. Vulture	90 1	50,000	265	8,100 lb. bombs for 1,630 m., 12 m/g.	
Shackleton MR.3	M.R.	10	4×2,450-h.p. Griffon 57A	120 6½	*86,000*	*300*	Restricted. 2 c/g.	7, 9, 12, 15, 35, 44, 49, 50, 57, 61, 83, 90, 97, 100, 101, 138, 148, 199, 214, 617.
Tutor	P.T.	2	1×240-h.p. Lynx IVC	34 0	2,458	122	—	44, 49, 50, 61, 83, 97, 106, 144, 207, 408.
Vulcan B.1	B.	5	4×12,000-lb. s.t. Olympus 102	99 0	*150,000+*	600+	Restricted	37, 38, 42, 120, 204, 206, 220, 224, 228, 240, 269.
York	Tp.	5	4×1,280-h.p. Merlin 20	102 0	68,597	298	24 pass.	—
B.E.								83, 101, 617.
2c	R.	2	1×90-h.p. R.A.F. 1a	37 0	2,142	72	224 lb. bombs (solo), 1 m/g.	24, 40, 51, 59, 99, 206, 242, 246, 511.
2e	R.	2	1×90-h.p. R.A.F. 1a	40 9	2,100	90	1 m/g.	
Blackburn								31, 114.
Beverley C.1	Tp.	4	4×2,850-h.p. Centaurus 173	162 0	135,000	242	94 pass. or 44,000 lb. freight	30, 31, 114, 142, 269.
Botha	C.R.	4	2×880-h.p. Perseus X	59 0	17,628	257	Torpedo or bombs, 3 m/g.	
Iris III	R.F-b.	5	3×675-h.p. Condor IIIB	97 0	29,000	118	2,000 lb. bombs, 3 m/g.	30, 47, 53.
Perth	R.F-b.	5	3×825-h.p. Buzzard IIMS	97 0	32,500	132	2,000 lb. bombs, 1 c/g, 3 m/g.	502, 608.
Boeing								209.
Fortress III	B.	8	4×1,200-h.p. Cyclone GR-1820-97	103 9	64,000	280	6,000 lb. bombs, 13 m/g.	204, 209.
Washington B.1	B.	10	4×2,200-h.p. Cyclone R-3350	141 3	140,000	350	6,000 lb. bombs for 3,000 m., 10 m/g.	
Boulton and Paul								59, 86, 206, 214, 220, 223, 251, 517, 519, 521.
Balliol T.2	A.T.	2	1×1,245-h.p. Merlin 35	39 4	8,410	288	4×60-lb. rockets, 1 m/g.	35, 44, 57, 90, 115, 149, 207.
Defiant I	F.	2	1×1,030-h.p. Merlin III	39 4	8,350	304	4 m/g.	
Overstrand	D.B.	5	2×580-h.p. Pegasus II M.3	72 0	12,000	153	1,600 lb. bombs, 3 m/g.	288.
Sidestrand III	D.B.	3–4	2×460-h.p. Jupiter VIIIF	71 11	10,200	140	1,050 lb. bombs, 3 m/g.	85, 96, 125, 141, 151, 153, 255, 256, 264, 275, 277, 281, 285, 286, 297, 288, 289, 307, 409, 410, 456, 667, 691.
Brewster								101.
Buffalo	F.	1	1×1,200-h.p. Cyclone GR-1820	35 0	6,840	313	4 m/g.	101.
Bristol								
Beaufighter IF	N.F.	2	2×1,425-h.p. Hercules III	57 10	21,000	330	4 c/g., 6 m/g.	60, 67, 71, 243, 453, 488.
Beaufighter VIC	S.F.	2	2×1,650-h.p. Hercules XVI	57 10	22,779	315	1 torpedo or 8 rockets, 4 c/g., 6 m/g.	
Beaufort I	T.B.	4	2×1,130-h.p. Taurus VI	58 0	17,030	270	1,500 lb. bombs or 1 torpedo, 4 m/g.	22, 25, 27, 29, 39, 42, 45, 46, 47, 68, 84, 89, 96, 108, 125, 141, 143, 144, 153, 176, 177, 211, 217, 219, 227, 234, 235, 236, 248, 252, 254, 255, 256, 272, 307, 404, 406, 409, 410, 455, 456, 459, 488, 489, 527, 600, 603, 604.
Blenheim I	D.B.	3	2×840-h.p. Mercury VIII	56 4	12,500	285	1,000 lb. bombs, 2 m/g.	22, 36, 39, 42, 47, 86, 203, 217, 415, 489.
Blenheim IV	D.B.	3	2×920-h.p. Mercury XV	56 4	13,500	266	1,320 lb. bombs, 5 m/g.	
Blenheim V	D.B.	3	2×830-h.p. Mercury 30	56 4	17,000	*240*	1,000 lb. bombs, 4 m/g.	8, 11, 13, 14, 15, 18, 21, 23, 25, 27, 29, 30, 34, 35, 39, 40, 42, 44, 45, 52, 53, 55, 57, 59, 60, 61, 62, 64, 68, 82, 84, 86, 88, 90, 92, 101, 103, 104, 107, 108, 110, 113, 114, 139, 142, 143, 144, 145, 150, 162, 203, 211, 218, 219, 222, 223, 224, 226, 234, 235, 236, 244, 248, 252, 254, 272, 326, 327, 342, 454, 500, 600, 601, 604, 608, 614.
Bombay	B/Tp.	3–4	2×1,010-h.p. Pegasus 22	95 9	20,000	192	2,000 lb. bombs or 24 pass. 2 m/g.	117, 216, 267.
Brigand B.1	B.	3	2×2,810-h.p. Centaurus 57	72 4	39,000	358	2,000 lb. bombs or rockets, 4 c/g.	8, 36, 42, 45, 84.
Buckmaster T.1	A.T.	3	2×2,520-h.p. Centaurus 7	71 10	33,700	352	—	
Bulldog IIA	F.	1	1×490-h.p. Jupiter VIIF	33 11	3,503	174	2 m/g., 4×20-lb. bombs	—
F.2B Fighter	F.	2	1×275-h.p. Falcon III	39 3	2,848	123	2 m/g., 2×112-lb. bombs	3, 17, 19, 23, 29, 32, 41, 54, 56, 111.
Sycamore HR.14	G.P.H.	5	1×520-h.p. Leonides 73	48 7*	5,600	127	—	2, 4, 5, 6, 8, 9, 11, 12, 13, 14, 16, 20, 22, 27, 28, 31, 33, 36, 39, 47, 48, 62, 76, 88, 100, 138, 139, 140, 141, 208.
Consolidated								22, 194, 275, 284.
Catalina I	R.F-B.	8–9	2×1,200-h.p. Twin Wasp R–1830	104 0	27,080	190	2,000 lb. bombs for 2,025 m., 6 m/g.	119, 190, 191, 202, 205, 209, 210, 212, 240, 244, 259, 262, 265, 270, 321, 330, 333, 413, 422, 490, 628.
Liberator VI	M.R.	8	4×1,200-h.p. Twin Wasp R–1830	110 0	62,000	297	4,000 lb. bombs for 2,290 m., 10 m/g.	8, 10, 37, 38, 40, 53, 59, 70, 86, 99, 102, 104, 108, 120, 147, 148, 159, 160, 178, 200, 203, 206, 215, 220, 223, 224, 231, 232, 233, 243, 246, 301, 321, 354, 355, 356, 357, 358, 502, 511, 547, 614.

Aircraft	Duty	Crew	Powerplant	Span	Gross weight	Max. speed	Military load	Squadrons
				ft. in.	lb.	m.p.h.		
Curtiss								
Kittyhawk III	F.	1	1×1,200-h.p. Allison V-1710-81	37 3½	8,850	375	6 m/g., 1,000 lb. bombs	94, 112, 250, 260, 450.
Mohawk IV	F.	1	1×1,200-h.p. Cyclone R-1820	37 3½	6,662	302	6 m/g., 400 lb. bombs	5, 28, 155.
Tomahawk IIB	F.	1	1×1,090-h.p. Allison V-1710-33	37 3½	8,058	340	6 m/g.	2, 4, 13, 26, 94, 112, 136, 168, 171, 208, 231, 239, 241, 250, 260, 268, 349, 400, 403, 414, 430, 613.
de Havilland								
D.H.4	D.B.	2	1×375-h.p. Eagle VIII	42 4½	3,472	143	460 lb. bombs, 2 m/g.	18, 25, 55, 57, 202, 205, 217, 220, 221, 222, 223, 224, 225, 226, 227, 273.
D.H.9	D.B.	2	1×230-h.p. B.H.P.	42 4½	3,669	111.5	460 lb. bombs, 2 m/g.	17, 27, 47, 49, 55, 98, 99, 103, 104, 107, 108, 144, 202, 206, 211, 212, 218, 220, 221, 222, 223, 224, 225, 226, 227, 236, 250, 273.
D.H.9a	D.B.	2	1×400-h.p. Liberty 12	45 11½	4,645	123	460 lb. bombs, 2 m/g.	8, 11, 12, 14, 15, 18, 27, 30, 35, 39, 45, 47, 55, 60, 84, 99, 100, 110, 205, 207, 221, 225, 501, 600, 601, 602, 603, 605.
D.H.10 Amiens III	D.B.	3	2×400-h.p. Liberty 12	65 6	9,000	124	900 lb. bombs, 2 m/g.	60, 104, 120, 216.
Chipmunk T.10	P.T.	2	1×145-h.p. Gipsy Major 8	34 4	2,100	138	—	—
Comet C.2	Tp.	5	4×7,350-lb. s.t. Avon 117/118	115 0	120,000	480†	44 pass.	216.
Devon C.1	Tp.	2	2×340-h.p. Gipsy Queen 70	57 0	8,500	210	8 pass.	31.
Dominie I	N.T.	2	2×200-h.p. Gipsy Six	48 0	5,500	157	3–4 persons	24.
Gipsy Moth	P.T.	2	1×120-h.p. Gipsy II	30 0	1,400	105	—	24.
Hornet F.3	F.	1	2×2,030-h.p. Merlin 130/131	45 0	21,300	472	4 c/g., 2,000 lb. bombs, rockets	19, 33, 41, 45, 64, 65, 80.
Mosquito B.IV	B.	2	2×1,250-h.p. Merlin 21	54 2	20,870	380	2,000 lb. bombs	4, 11, 13, 14, 16, 18, 21, 23, 25, 29, 34, 36, 39, 45, 47, 55, 58, 68, 69, 81, 82, 84, 85, 89, 96, 98, 105, 107, 109, 110, 125, 128, 139, 140, 141, 142, 143, 151, 157, 162, 163, 169, 176, 180, 192, 219, 235, 239, 248, 255, 256, 264, 305, 307, 333, 334, 404, 406, 409, 410, 418, 419, 456, 464, 487, 488, 540, 544, 571, 578, 600, 604, 605, 608, 613, 614, 627, 680, 684, 692, 693.
Mosquito F.VI	F.B.	2	2×1,635-h.p. Merlin 25	54 2	22,300	380	4 c/g., 4 m/g., 2,000 lb. bombs	
Mosquito PR.34	P.R.	2	2×1,710-h.p. Merlin 76	54 2	25,500	425	Cameras	
Tiger Moth II	P.T.	2	1×130-h.p. Gipsy Major	29 4	1,825	109	—	—
Vampire F.1	F.	1	1×3,100-lb. s.t. Goblin 2	40 0	8,578	540	4 c/g.	3, 4, 5, 6, 8, 11, 16, 20, 23, 25, 26, 28, 32, 54, 60, 67, 71, 72, 73, 93, 94, 98, 118, 130, 145, 213, 247, 249, 266, 501, 502, 601, 602, 603, 604, 605, 608, 609, 612, 613, 614.
Vampire NF.10	N.F.	2	1×3,350-lb. s.t. Goblin 3	38 0	11,350	550	4 c/g	
Vampire T.11	A.T.	2	1×3,500-lb. s.t. Goblin 35	38 0	12,920	549	2 c/g., bombs, rockets	
Venom FB.4	F.B.	1	1×4,850-lb. s.t. Ghost 103	41 8		640+	4 c/g., 2,000 lb. bombs or 16 rockets	5, 6, 8, 11, 16, 23, 28, 32, 33, 45, 60, 73, 89, 94, 98, 125, 141, 145, 151, 219, 249, 253, 266.
Venom NF.3	N.F.	2	1×4,850-lb. s.t. Ghost 103	41 8		630	4 c/g.	
Douglas								
Boston III	B.	4	2×1,600-h.p. Double Cyclone GR-2600	61 4	25,600	342	2,000 lb. bombs for 1,020 m., 8 m/g.	13, 14, 18, 55, 88, 107, 114, 226, 342, 418, 605.
Dakota I	Tp.	3	2×1,200-h.p. Twin Wasp R-1830	95 0	29,300	230	28 pass.	10, 18, 24, 27, 30, 31, 46, 48, 52, 53, 62, 70, 76, 77, 78, 96, 110, 117, 147, 167, 187, 194, 204, 215, 216, 233, 238, 243, 267, 271, 353, 357, 435, 436, 437, 510, 512, 525, 575.
Havoc I	N.F.	2	2×1,200-h.p. Twin Wasp R-1830	61 4	19,040	295	8 m/g.	23, 85, 93, 418, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 605.
English Electric								
Canberra B.2	B.	3	2×6,500-lb. s.t. Avon 101	63 11½	*42,000*	*620*	N.A.	9, 10, 12, 13, 15, 17, 18, 21, 27, 31, 32, 35, 40, 44, 50, 57, 58, 61, 69, 73, 76, 80, 82, 88, 90, 100, 101, 102, 109, 115, 139, 149, 207, 213, 249, 540, 541, 543, 617.
Canberra B.(I)8	F.B.	2	2×7,500-lb. s.t. Avon 109	63 11½	*45,000*	*620*	4 c/g., 2,000-lb. bombs	
Canberra PR.9	P.R.	2	2×10,000-lb. s.t. Avon 206	68 0			Cameras	
P.1B	F.	1	2×Avon+1 Double Scorpion	34 10		*1,500*	2 c/g., 2 Firestreak missiles	—
Fairey								
IIIC	R./F.	2	1×375-h.p. Eagle VIII	46 1½	4,800	110.5	2 m/g., bombs	229, 267.
IIID	G.P.	3	1×450-h.p. Napier Lion II or V	46 1½	5,050	120	2 m/g., bombs	202, 441, 444, 481.
IIIF	G.P.	2	1×570-h.p. Napier Lion XIA	45 9	6,041	120	2 m/g., 500 lb. bombs	8, 14, 24, 35, 45, 47, 202, 207.
Battle	B.	3	1×1,030-h.p. Merlin I, II, III or V	54 0	10,792	257	1,000 lb. bombs for 1,050 m., 2 m/g.	12, 15, 18, 26, 35, 40, 52, 63, 88, 98, 103, 105, 142, 150, 185, 207, 218, 226, 300, 301, 304, 305, 611, 616.
Fawn	D.B.	2	1×450-h.p. Napier Lion II	49 11	5,834	114	460 lb. bombs, 2 m/g.	11, 12, 100, 503, 602.
Fox I	D.B.	2	1×430-h.p. Felix (Curtiss D.12)	38 0	4,117	156.5	460 lb. bombs, 2 m/g.	12.
Gordon	B./G.P.	2	1×525-h.p. Panther IIA	45 9	5,906	145	460 lb. bombs, 2 m/g.	6, 14, 35, 40, 45, 47, 207.
Hendon II	N.B.	5	2×600-h.p. Kestrel VI	101 9	20,000	155	1,660 lb. bombs, 3 m/g.	38, 115.
F.E.								
2b	F./N.B.	2	1×160-h.p. Beardmore	47 9	3,037	91.5	2 m/g., 340 lb. bombs	38, 39, 51, 58, 83, 100, 101, 102, 148, 149, 191, 192, 199, 200.
Felixstowe								
F.2A	R.F-b.	4	2×345-h.p. Eagle VIII	95 7½	10,978	95.5	4 m/g., 460 lb. bombs	201, 212, 228, 230, 233, 234, 240, 247, 249, 256, 257, 259, 267.
F.5	R.F-b.	4	2×345-h.p. Eagle VIII	103 8	12,268	102.5	4 m/g., 920 lb. bombs	230, 231, 232, 238, 247, 249, 259, 261, 267, 480.
Gloster								
Gamecock I	F.	1	1×425-h.p. Jupiter VI	29 9½	2,863	155	2 m/g.	3, 17, 23, 32, 43.
Gauntlet	F.	1	1×645-h.p. Mercury VIS	32 10	3,970	230	2 m/g.	6, 17, 19, 32, 46, 54, 56, 65, 66, 73, 74, 79, 80, 111, 151, 213, 504, 601, 602, 615, 616.
Gladiator	F.	1	1×840-h.p. Mercury IX	32 3	4,750	245	4 m/g.	3, 6, 25, 33, 46, 54, 56, 65, 72, 73, 79, 80, 85, 87, 94, 112, 247, 261, 263, 602, 603, 605, 607, 615.
Grebe II	F.	1	1×385-h.p. Jaguar IV	29 4	2,614	152	2 m/g., 4×20-lb. bombs	19, 25, 29, 32, 41, 56.
Javelin FAW.1	A.W.F.	2	2×8,150-lb. s.t. Sapphire 6	52 0	*32,000*	*710*	4 c/g.	23, 41, 46, 87, 141, 151.
Meteor F.1	F.	1	2×1,700-lb. s.t. Welland 1	43 0	13,800	445	4 c/g.	1, 2, 33, 34, 41, 43, 54, 56, 63, 64, 66, 72, 74, 79, 81, 92, 124, 208, 222, 245, 257, 263, 266, 500, 504, 541, 600, 601, 604, 609, 610, 611, 615, 616, 695.
Meteor T.7	A.T.	2	2×3,500-lb. s.t. Derwent 5	37 2	14,140	585	—	
Meteor F.8	F.	1	2×3,500-lb. s.t. Derwent 8	37 2	19,100	592	4 c/g.	
Meteor PR.10	P.R.	1	2×3,500-lb. s.t. Derwent 8	43 0	18,765	574	Cameras	
Handley Page								
Halifax I	N.B.	7	4×1,280-h.p. Merlin X	98 10	58,000	273	6,750 lb. bombs for 1,840 m., 8 m/g.	10, 35, 51, 58, 76, 77, 78, 102, 103, 138, 148, 158, 161, 171, 178, 190, 192, 199, 202, 224, 227, 295, 296, 297, 298, 301, 304, 346, 347, 405, 408, 415, 419, 420, 424, 425, 426, 427, 428, 429, 431, 432, 433, 434, 460, 462, 466, 502, 517, 518, 519, 520, 521, 546, 547, 578, 614, 620, 640, 644, also 1341, 1577 and 1675 Flts.
Halifax A.IX	Tp.	4	4×1,675-h.p. Hercules XVI	104 2	65,000	285	16 paratroops, freight, 2 m/g.	10, 47, 113, 187, 296, 297, 298, 301, 304, 620 (includes A.VII and C.VIII).

Abbreviations.—A.C., army co-operation; Am., amphibian; A.O.P., air observation post; A.T., advanced trainer; A.W.F., all-weather fighter; B., bomber; B.T., basic trainer; c/g., cannon; C.R., coastal reconnaissance; D.B., day bomber; F., fighter; F.B., fighter bomber; F-b., flying-boat; G.P., general purpose; G.P.H., general-purpose helicopter; G.T., glider tug; m., miles; m/g., machine-gun; M.R., maritime reconnaissance; N.B., night bomber; N.F., night fighter; N.T., navigation trainer; pass., passengers; P.R., photographic reconnaissance; P.T., primary trainer; R., reconnaissance; R.T., radio trainer; S.F., strike fighter; T., trainer; Tp., transport; T.B., torpedo bomber; T.T., target tug. ° rotor diameter; † cruising speed. Data in *italics* are estimated. ‡Data appearing in "Aircraft of the Royal Air Force, 1918-57" by Owen Thetford (Putnam), have been used as a basis for compiling the list of squadrons.

R.A.F. Aircraft over four decades . . .

Aircraft	Duty	Crew	Powerplant	Span	Gross weight	Max. speed	Military load	Squadrons
Handley Page (Contd.)				ft. in.	lb.	m.p.h.		
Hampden I	B.	4	2×980-h.p. Pegasus XVIII	69 2	18,756	265	4,000 lb. bombs for 1,200 m., 8 m/g.	7, 44, 49, 50, 61, 76, 83, 97, 106, 144, 185, 207, 408, 415, 420, 455, 517, 519, 521.
Harrow II	B.	4	2×925-h.p. Pegasus XX	88 5	23,000	200	3,000 lb. bombs, 4 m/g.	37, 75, 93, 115, 214, 215, 271.
Hastings C.2	Tp.	5	4×1,675-h.p. Hercules 106	113 0	80,000	348	50 troops, 32 stretchers or freight	24, 47, 48, 53, 59, 70, 99, 202, 297, 511.
Hereford	T.	5	2×1,000-h.p. Dagger	113 0			—	185.
Heyford IA	N.B.	4	2×525-h.p. Kestrel IIIS	75 0	16,750	142	2,800 lb. bombs, 3 m/g.	7, 9, 10, 97, 99, 102, 149, 166.
Hinaldi	N.B.	4	2×460-h.p. Jupiter VIII	75 0	14,486	113	1,450 lb. bombs, 3 m/g.	10, 99.
Hyderabad	N.B.	4	2×455-h.p. Napier Lion	75 0	13,590	109	1,100 lb. bombs, 3 m/g.	10, 99, 502, 503.
Marathon T.11	N.T.	5	4×340-h.p. Gipsy Queen 173	65 0	18,250	232.5	—	—
0/400	N.B.		2×360-h.p. Eagle VIII	100 0	13,360	97.5	16×112-lb. bombs, 4 m/g.	58, 70, 97, 100, 115, 207, 214, 215, 216.
V/1500	N.B.	5–7	4×375-h.p. Eagle VIII	126 0	24,700	97	7,500 lb. bombs, 4 m/g.	166, 167.
Victor B.1	B.	5	4×Sapphire	110 0		600+	Restricted	—
Hawker								
Audax	A.C.	2	1×530-h.p. Kestrel IB.	37 3	4,381	170	4×20-lb. bombs or supply containers, 2 m/g.	2, 4, 5, 13, 16, 20, 26, 28, 52, 63, 208, 237.
Demon	F.	2	1×560-h.p. Kestrel V	37 3	4,669	181.5	3 m/g., light bombs	6, 23, 25, 29, 41, 64, 65, 74, 600, 601, 604, 607, 608.
Fury I	F.	1	1×525-h.p. Kestrel IIS	30 0	3,490	214	2 m/g.	1, 25, 43.
Fury II	F.	1	1×640-h.p. Kestrel VI	30 0	3,609	223	2 m/g.	25, 41, 73, 87.
Hardy	G.P.	2	1×625-h.p. Kestrel X	37 3	4,971	164	2 m/g., 2 supply containers or bombs	6, 30, 237.
Hart	D.B.	2	1×525-h.p. Kestrel IB	37 3	4,554	184	500 lb. bombs, 2 m/g.	6, 11, 12, 15, 18, 21, 24, 33, 39, 52, 57, 60, 142, 600, 601, 602, 603, 605, 609, 610, 611.
Hector	A.C.	2	1×805-h.p. Dagger III M.S.	36 11½	4,887	187	2 m/g., 2 supply containers or bombs	2, 4, 13, 16, 26, 53, 59, 602, 612, 613, 614, 615.
Henley III	T.T.	2	1×1,030-h.p. Merlin II	47 10½	8,840	272	—	639, 695.
Hind	D.B.	2	1×640-h.p. Kestrel V	37 3	5,298	187	2×250-lb. bombs, 2 m/g.	12, 15, 18, 21, 34, 40, 49, 50, 52, 57, 61, 62, 63, 82, 83, 88, 90, 98, 103, 104, 106, 107, 108, 113, 114, 139, 142, 211, 500, 501, 502, 503, 504, 602, 603, 605, 609, 610, 611.
Horsley II	D.B.	2	1×690-h.p. Condor IIIA	56 9	7,800	126	600 lb. bombs or torpedo, 2 m/g.	11, 15, 33, 36, 100, 504.
Hunter F.6	F.	1	1×10,000-lb. s.t. Avon	33 8	15,000+	700+	4 c/g., bombs, rockets	1, 3, 4, 14, 20, 26, 34, 41, 43, 54, 56, 63, 65, 66, 67, 71, 74, 92, 93, 98, 111, 112, 118, 130, 208, 222, 234, 245, 247, 257, 263.
Hurricane I	F.	1	1×1,030-h.p. Merlin II or III	40 0	6,666	316	8 m/g.	1, 3, 5, 6, 11, 17, 20, 27, 28, 30,, 32, 33, 34, 42, 43, 46, 56, 60, 63, 67, 71, 73, 74, 79, 80, 81, 85, 87, 91, 92, 94, 96, 98, 111, 113, 116, 123, 126, 127, 128, 130, 131, 133, 134, 135, 136, 137, 145, 146, 151, 164, 174, 175, 176, 181, 182, 184, 185, 208, 213, 225, 229, 232, 237, 238, 239, 241, 242, 245, 247, 249, 250, 253, 257, 258, 260, 261, 263, 273, 274, 285, 286, 288, 289, 290, 302, 303, 306, 308, 309, 310, 312, 315, 316, 317, 318, 331, 332, 335, 336, 351, 401, 402, 417, 421, 422, 438, 439, 440, 451, 486, 488, 501, 504, 516, 527, 567, 577, 587, 595, 601, 605, 607, 615, 631, 639, 667, 695.
Hurricane IIC	F.B.	1	1×1,280-h.p. Merlin XX	40 0	8,710	339	4 c/g., 2×500-lb. bombs	
Hurricane IV	F.	1	1×1,480-h.p. Merlin 21	40 0		314	2×40-mm. guns, 2 m/g., etc.	
Tempest II	F.	1	1×2,530-h.p. Centaurus 5	41 0	14,125	440	4 c/g., 2,000 lb. bombs or rockets	3, 5, 6, 8, 16, 20, 26, 30, 33, 39, 54, 56, 80, 152, 213, 222, 247, 266, 274, 287, 349, 486, 501.
Tempest V	F.	1	1×2,180-h.p. Sabre II	41 0	11,500	435	4 c/g., 2,000 lb. bombs or rockets	
Tomtit	P.T.	2	1×150-h.p. Mongoose IIIC	28 6	1,750	124	—	24.
Typhoon IB	F.B.	1	1×2,180-h.p. Sabre II	41 7	11,400	405	4 c/g., 2×1,000-lb. bombs or 8 rockets	1, 3, 33, 54, 56, 80, 137, 164, 168, 174, 175, 181, 182, 183, 184, 193, 195, 197, 198, 245, 247, 257, 263, 266, 274, 411, 416, 438, 439, 440, 486, 609.
Woodcock II	N.F.	1	1×420-h.p. Jupiter IV	32 6	3,040	138	2 m/g.	3, 17.
Hunting								
Jet Provost T.3	B.T.	2	1×1,750-lb. s.t. Viper 102	36 11	7,092	326	Optional 2 m/g., bombs, etc.	—
Pembroke C.1	Tp.	2	2×550-h.p. Leonides 127	64 6	13,500	224	8 pass.	81, 84, 267.
Provost T.1	B.T.	2	1×550-h.p. Leonides 126	35 2	4,400	200	—	—
Lockheed								
Hudson I	C.R.	5	2×1,100-h.p. Cyclone GR-1820	65 6	17,500	246	750 lb. bombs, 7 m/g.	36, 48, 53, 59, 62, 117, 139, 161, 163, 194, 200, 206, 216, 217, 220, 223, 224, 233, 251, 267, 269, 277, 279, 280, 281, 320, 321, 353, 357, 459, 500, 608.
Neptune MR.1	M.R.	7	2×3,250-h.p. Turbo-Cyclone R-3350	104 0	72,000	353	8,000 lb. bombs, rockets, 4 m/g., 2 c/g.	36, 210, 217.
Ventura II	B.	5	2×2,000-h.p. Double Wasp R-2800	65 6	26,000	300	2,500 lb. bombs, 8 m/g.	13, 21, 299, 464, 487, 500, 519, 521, 624.
Martin								
Baltimore III	B.	4	2×1,660-h.p. Cyclone R-2600	61 4	23,000	302	2,000 lb. bombs for 950 m., 14 m/g.	13, 52, 55, 203, 223, 454, 500.
Marauder III	B.	5	2×2,000-h.p. Double Wasp R-2800	71 0	37,000	305	4,000 lb. bombs for 1,200 m., 11 m/g.	14, 39, 326, 327, 454.
Maryland II	R.B.	3	2×1,200-h.p. Twin Wasp R-1830	61 4	16,809	278	2,000 lb. bombs for 1,080 m., 8 m/g.	39, 69, 223 and 431 Flt.
Miles								
Magister	P.T.	2	1×130-h.p. Gipsy Majorl	33 10	1,863	145	—	—
Martinet	T.T.	2	1×870-h.p. Mercury XX	39 0	6,600	237	—	269, 285, 286, 287, 289, 290, 291, 567, 577, 587, 595, 598, 631, 639, 679, 691, 695.
Master II	A.T.	2	1×870-h.p. Mercury XX	35 9	5,312	260	—	—
Nieuport								
Nightjar	F.	1	1×230-h.p. B.R.2	28 0	2,165	120	2 m/g.	203. Also 401 Flt.
Scout	F.	1	1×110-h.p. Le Rhône	27 0	1,232	107	1 m/g.	14, 113.
North American								
Harvard T.2B	A.T.	2	1×550-h.p. Wasp R-1340	42 0	5,250	205	1 m/g., practice bombs	—
Mitchell II	B.	5	2×1,700-h.p. Cyclone R-2600	67 7	24,000	292	4,000 lb. bombs for 1,635 m., 6 m/g.	98, 180, 226, 305, 320, 342.
Mustang III	F.B.	1	1×1,520-h.p. Packard V-1650 (Merlin)	37 0½	9,200	450	4 m/g., 2×500-lb. bombs	19, 64, 65, 94, 112, 118, 122, 126, 129, 213, 234, 241, 249, 260, 268, 303, 306, 309, 315, 316, 345, 441, 442, 611.
Sabre F.4 (Canadair)	F.	1	1×5,200-lb. s.t. J47-GE-13	37 1	16,500	670+	6 m/g.	3, 4, 20, 26, 66, 67, 71, 92, 112, 118, 130, 234.
Norman Thompson								
N.T.2B	F-b.T.	2	1×212-h.p. Arab	48 4½	3,169	85	—	—
Percival								
Prentice T.1	P.T.	2	1×251-h.p. Gipsy Queen 32	46 0	4,200	143	—	—
Proctor IV	R.T./Tp.	3–4	1×208-h.p. Gipsy Queen II	39 6	3,500	160	—	31.
R.E.								
8	R.	2	1×150-h.p. R.A.F .4a	42 7	2,869	98	2 m/g., 2×112-lb. bombs	4, 5, 6, 7, 9, 12, 13, 14, 15, 16, 21, 30, 34, 42, 52, 53, 59, 63, 105, 106, 113, 142.
Republic								
Thunderbolt II	F.B.	1	1×2,300-h.p. Double Wasp R-2800	40 9½	14,600	427	8 m/g., 2×1,000-lb. bombs	5, 30, 34, 42, 60, 79, 81, 113, 123, 131, 134, 135, 146, 258, 261, 615.

Aircraft	Duty	Crew	Powerplant	Span	Gross weight	Max. speed	Military load	Squadrons
				ft. in.	lb.	m.p.h.		
Saunders-Roe								
Cloud	Am.T.	2	2×340-h.p. Serval	64 0	9,500	118	8 pass.	48.
Lerwick	R.F-b.	6	2×1,375-h.p. Hercules II	80 10		213	2,000 lb. bombs, 7 m/g.	209, 240.
London II	R.F-b.	6	2×960-h.p. Pegasus X	80 0	18,400	155	2,000 lb. bombs, 3 m/g.	201, 202, 204, 240.
Scottish Aviation								
Pioneer CC.1	Tp.	1	1×540-h.p. Leonides 502 or 503	49 9	5,800	145	3–4 pass.	78, 215, 267.
Twin Pioneer	Tp.	1	2×540-h.p. Leonides 514	76 6	13,500	165	16 pass., 12 stretchers or 2,000 lb. bombs	—
S.E.								
5A	F.	1	1×200-h.p. Viper	26 7½	1,940	138	2 m/g., 4×25-lb. bombs	1, 24, 29, 32, 37, 40, 41, 50, 56, 60, 61, 64, 74, 84, 85, 92, 94, 111, 143, 145, 229.
Short								
184	C.R.	2	1×260-h.p. Sunbeam	63 6½	5,363	88.5	520 lb. bombs or 14-in. torpedo, 1 m/g.	219, 229, 233, 234, 235, 237, 238, 239, 240, 241, 242, 243, 245, 246, 248, 251, 253, 257, 266.
320	C.R.	2	1×345-h.p. Cossack	75 0	7,021	79	2×230-lb. bombs or 14-in. torpedo, 1 m/g.	237, 248, 266, 268, 271.
Singapore III	R.F-b.	6	4×630-h.p. Kestrel VIII/IX	90 0	27,500	145	2,000 lb. bombs, 3 m/g.	203, 205, 209, 210, 230, 240.
Stirling III	N.B.	7–8	4×1,650-h.p. Hercules VI or XVI	99 1	70,000	270	14,000 lb. bombs for 590 m., 8 m/g.	7, 15, 51, 75, 90, 138, 149, 161, 171, 190, 196, 199, 214, 218, 295, 299, 513, 570, 620, 622, 623, 624.
Stirling V	Tp.	5	4×1,650-h.p. Hercules XVI	99 1	70,000	280	14 pass., 40 troops or freight	46, 48, 158, 242, 299.
Sunderland MR.5	R.F-b.	7	4×1,200-h.p. Twin-Wasp R-1830	112 9½	60,000	213	2,000 lb. bombs for 1,690 m., 7 m/g.	69, 88, 95, 119, 201, 202, 204, 205, 209, 210, 228, 230, 240, 246, 270, 330, 343, 422, 423, 461, 490.
Sopwith								
1½-Strutter	F.	2	1×130-h.p. Clerget 9Bc	33 6	2,150	100	2 m/g., light bombs	208.
Camel F.1	F.	1	1×130-h.p. Clerget	28 0	1,453	115	2 m/g., 4×25-lb. bombs	3, 28, 37, 39, 43, 44, 45, 46, 50, 54, 61, 65, 66, 70, 72, 73, 78, 80, 87, 112, 143, 150, 151, 152, 188, 189, 198, 201, 203, 204, 208, 209, 210, 213, 221, 222, 223, 224, 273.
Cuckoo T.1	T.B.	1	1×200-h.p. Arab	46 9	3,883	103.5	1×18-in. torpedo	185, 210.
Dolphin 5F.1	F.	1	1×200-h.p. Hispano-Suiza	32 6	2,008	127.5	2–4 m/g., 4×25-lb. bombs	19, 23. 79, 87.
Snipe 7F.1	F.	1	1×230-h.p. B.R.2	31 1	2,020	121	2 m/g., 4×25-lb. bombs	1, 3, 17, 19, 23, 25, 29, 32, 41, 43, 56, 71, 81, 111, 201, 208.
Supermarine								
Scapa	R.F-b.	5	2×525-h.p. Kestrel III M.S.	75 0	16,040	141.5	1,000 lb. bombs, 3 m/g.	202, 240.
Sea Otter	G.P.Am.	3–4	1×870-h.p. Mercury 30	46 0	10,000	150	3 m/g.	276, 278, 281, 282, 292. Also 1350, 1351 and 1352 Flts.
Southampton II	R.F-b.	5	2×502-h.p. Lion V	75 0	15,200	108	1,100 lb. bombs, 3 m/g.	201, 203, 204, 205, 210.
Spitfire IA	F.	1	1×1,030-h.p. Merlin II or III	36 10	5,332	355	8 m/g.	1, 2, 4, 5, 11, 16, 17, 19, 20, 26, 28, 32, 33, 34, 41, 43, 54, 56, 58, 60, 63, 64, 65, 66, 67, 69, 71, 72, 73, 74, 80, 81, 87, 91, 92, 93, 94, 111, 117, 118, 121, 122, 123, 124, 126, 127, 129, 130, 131, 132, 133, 134, 136, 140, 145, 152, 154, 155, 164, 165, 167, 185, 208, 222, 225, 229, 232, 234, 237, 241, 242, 243, 249, 253, 258, 266, 268, 302, 303, 306, 308, 310, 312, 313, 315, 316, 317, 318, 322, 328, 329, 331, 332, 340, 341, 345, 349, 350, 352, 400, 401, 402, 403, 404, 411, 412, 414, 416, 417, 421, 430, 441, 442, 443, 451, 452, 453, 457, 485, 501, 502, 504, 521, 528, 529, 541, 542, 543, 544, 567, 577, 587, 595, 600, 601, 602, 603, 604, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 667, 681, 682, 683, 691, 695.
Spitfire VB	F.	1	1×1,470-h.p. Merlin 45 or 46	36 10	6,622	374	2 c/g., 4 m/g., 1×500-lb. bomb	
Spitfire F.IX	F.	1	1×1,565-h.p. Merlin 61 or 63	36 10	7,300	408	2 c/g., 4 m/g., 1,000 lb. bombs	
Spitfire F.XIV	F.	1	1×2,035-h.p. Griffon 65	36 10	8,490	448	2 c/g., 4 m/g., 1,000 lb. bombs	
Spitfire F.22	F.	1	1×2,050-h.p. Griffon 61 or 85	36 11	9,900	454	4 c/g., 1,000 lb. bombs	
Stranraer	R.F-b.	6	2×920-h.p. Pegasus X	85 0	19,000	150	1,000 lb. bombs for 760 m., 3 m/g.	201, 209, 228, 240.
Swift FR.5	R.F.	1	1×7,500-lb. s.t. Avon R.A.7R.	32 4	*18,000*	700+	2 c/g., cameras	2, 79.
Walrus II	R.Am.	4	1×775-h.p. Pegasus VI	45 10	7,200	135	2 m/g.	269, 275, 276, 277, 278, 281, 282, 283, 284, 293, 294, 624.
Taylorcraft								
Auster V	A.O.P.	3	1×130-h.p. Lycoming O-290	36 0	1,700	130	—	651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 671, 672, 673.
Vickers								
Valentia	Tp.	2	2×650-h.p. Pegasus II L3 or M.3	87 4	19,500	130	22 troops or 2,200 lb. bombs	31, 70, 216, 244.
Valetta C.2	Tp.	4	2×1,975-h.p. Hercules 230	89 3	36,500	294	9–15 pass. or freight	30, 48, 52, 70, 78, 84, 110, 114, 167, 204, 216.
Valiant B.(K).1	B.	5	4×10,000-lb. s.t. Avon R.A.28	114 4	*160,000*	600+	—	7, 49, 90, 138, 148, 207, 214, 543.
Varsity	T.	9	2×1,950-h.p. Hercules 264	95 8	37,500	288	600 lb. practice bombs	173, 187.
Vernon	Tp.	3	2×450-h.p. Lion II	68 1	12,544	100	11 pass.	45, 70.
Victoria V	Tp.	2	2×570-h.p. Lion XI	87 4	17,760	110	22 pass.	70, 216.
Vildebeeste III	T.B.	3	1×660-h.p. Pegasus II M.3	49 0	8,500	143	1×18-in. torpedo or 1,000 lb. bombs, 2 m/g.	22, 36, 42, 100, 273.
Vimy IV	B.	3	2×360-h.p. Eagle VIII	68 1	10,884	100	2,476 lb. bombs, 2 m/g.	7, 9, 45, 58, 70, 100, 216, 502.
Vincent	G.P.	3	1×660-h.p. Pegasus II M.3	49 0	8,100	142	1,000 lb. bombs, 2 m/g.	5, 8, 28, 31, 47, 55, 84, 94, 207, 223, 244.
Virginia X	N.B.	4	2×570-h.p. Lion XI	87 8	17,600	108	3,000 lb. bombs, 3 m/g.	7, 9, 10, 51, 58, 97, 214, 215, 500, 502.
Warwick V	C.R.	6	2×2,520-h.p. Centaurus VII	96 8½	50,000	290	2,000 lb. bombs for 2,080 m., 7 m/g.	38, 179, 269, 275, 276, 279, 280, 281, 282, 283, 284, 292, 293, 294, 621.
Wellesley	B.	2	1×925-h.p. Pegasus XX	74 7	11,100	228	2,000 lb. bombs, 2 m/g.	7, 14, 35, 45, 47, 76, 77, 148, 207, 223.
Wellington II	N.B.	6	2×1,145-h.p. Merlin X	86 2	27,600	247	4,000 lb. bombs	8, 9, 12, 14, 15, 24, 36, 37, 38, 40, 57, 69, 70, 75, 99, 100, 101, 103, 104, 108, 109, 115, 142, 148, 149, 150, 156, 162, 166, 172, 179, 192, 196, 199, 203, 214, 215, 218, 221, 242, 244, 300, 301, 304, 305, 311, 326, 407, 415, 419, 420, 424, 425, 426, 427, 428, 429, 431, 432, 458, 460, 466, 467, 524, 544, 547, 612, 621.
Wellington III	N.B.	6	2×1,560-h.p. Hercules XI	86 2	29,500	255	4,500 lb. bombs for 1,540 m., 8 m/g.	
Vultee								
Vengeance	B.	2	1×1,700-h.p. Double-Cyclone GR-2600	48 0	12,480	279	2,000 lb. bombs, 6 m/g.	27, 45, 62, 82, 84, 110, 288, 289, 567, 577, 587, 595, 631, 667, 691, 695.
Westland								
Dragonfly HC.4	G.P.H.	4	1×520-h.p. Leonides 50	49 0*	5,870	95	—	194.
Lysander I	A.C.	2	1×890-h.p. Mercury XII	50 0	5,920	229	6 light bombs, 4 m/g.	2, 4, 6, 13, 16, 20, 26, 28, 116, 138, 161, 208, 231, 237, 239, 241, 268, 275, 276, 277, 281, 400, 414, 451, 613, 614.
Wallace II	G.P.	2	1×680-h.p. Pegasus IV	46 5	5,750	158	2 m/g., 580 lb. bombs	501, 504, 608.
Wapiti	G.P.	2	1×550-h.p. Jupiter VIII.F or IX.F	46 5	5,400	144	2 m/g., 580 lb. bombs, etc.	5, 11, 20, 27, 28, 30, 31, 39, 55, 60, 84, 501, 502, 600, 601, 602, 603, 604, 605, 607, 608.
Whirlwind	F.	1	2×885-h.p. Peregrine I	45 0	10,270	360	4 c/g., 500 lb. bombs	137, 263.
Whirlwind HAR.4	G.P.H.	2	1×600-h.p. Wasp R-1340-57	53 0*	6,800	110	10 pass., 6 stretchers or freight	22, 155, 194, 284.

Abbreviations.—A.C., army co-operation; Am., amphibian; A.O.P., air observation post; A.T., advanced trainer; A.W.F., all-weather fighter; B., bomber; B.T., basic trainer; c/g., cannon; C.R., coastal reconnaissance; D.B., day bomber; F., fighter; F.B., fighter bomber; F-b., flying-boat; G.P., general purpose; G.P.H., general-purpose helicopter; G.T., glider tug; m., miles; m/g., machine-gun; M.R., maritime reconnaissance; N.B., night bomber; N.F., night fighter; N.T., navigation trainer; pass., passengers; P.R., photographic reconnaissance; P.T., primary trainer; R., reconnaissance; R.T., radio trainer; S.F., strike fighter; T., trainer; Tp., transport; T.B., torpedo bomber; T.T., target tug. * rotor diameter; † cruising speed. Data in *italics* are estimated.

PRIVATE FLYING

H.J.C.'s Club Commentary:

● NOW HAVING its own aeroplane is the **Vickers Flying School,** which does most of its flying from White Waltham. The aircraft is an Auster III, G-AHLI, which has been transferred to the club from the parent company. Vickers-Armstrongs also operate another Auster III, G-AHLK, which has been transferred for the use of Mr. J. W. C. Judge, Supermarine test pilot.

Since the formation of the club its 20 members have flown a total of 440 hr. 30 min.; 15 members have flown solo and seven have gained their licences. The newest licence holders are Messrs. J. Awdry and N. Roskrow.

On April 12 a tea patrol (15.15 hr.-15.45 hr.) is to be held when the Vickers club aircraft will defend White Waltham against attack from the Weybridge, Hurn and Supermarine clubs.

● REFERENCE is made in the latest newsletter from the **Fair Oaks Aero-Club** to the claims made recently by another club in "an aeronautical publication" (and we humbly bow) about its C.P.L. course. The C.P.L. course at Fair Oaks, it is pointed out, began on February 2. It is for 36 weeks and consists of 531 hr. of lectures, and *ab initio* students are required to fly a total of 150 hr. progressive flying, i.e., 70 hr. in Tigers, 30 hr. in Austers and 50 hr. in Chipmunks. The total includes 10 hr. of night flying. The ground training is in accord with the Approved C.P.L. syllabus and given by the club's own instructors, three of whom hold C.P.L.s, including one with an instrument rating. A Link trainer is available. The fee for the course is £1,050.

P.P.L.s have been gained by Messrs. Gadd, Meaden, Cartwright, Swift and Papworth, Miss Hawkins, and A.T.C. cadets Simpson, O'Connor, Craig-Wood, Gale and Simmons. Mr. Layton has flown his first solo, and R/T licences have been gained by Messrs. Murray, Avis, White, Worth, Dodd, Lane, Loyal, Wise, Colpus, King and Foster and Miss Mackellar.

A Whitsun week-end at Antwerp is planned for May 24-26.

CROYDON HOPES.—Now being assembled in Rollasons' hangar are, left, the Arrow Active, G-ABVE, to which we recently referred and the Tiger Moth, G-APDZ, which is being specially modified for C. A. Nepean Bishop's aerobatic performances.

Photograph copyright "The Aeroplane"

● DESPITE changeable weather in February the **Oxford Aeroplane Club** at Kidlington flew 109 hr., 20 hr. of which were by private owners. Messrs. Westlund and Gibbons gained their licences.

The club is to institute a spot-landing competition about the end of next month. Rules will be announced in due course.

GLIDING NOTES

MODERN fast sailplanes have been replacing the older and slower types so gradually that it is not universally realized that instructors are having to change their methods. This came out at the B.G.A. Instructors' Conference held at the Kronfeld Club on March 15, when the question arose whether pupils should be urged more strongly to guard against undershooting than against overshooting, rather than the other way round, when they are faced with a landing in a small field.

Wg. Cdr. G. J. C. Paul, accidents analysis officer of the British Gliding Association, had gone through the records right back to 1949, when the analyses first began. In this nine-year period there were nine cases of damage due to overshooting, compared with 55 due to undershooting, of which 25 could be classified as the result of "stretch and stall." In view of this preponderance of undershooting, John Furlong suggested that the right technique for getting into a small field is to "try and land up to the far hedge"; even if you hit it, you do much less damage than if you had undershot. He suggested training pupils to land up to a dummy hedge which they could knock down with impunity.

Lasham's chief instructor, Derek Piggott, on the other hand, thought that statistics going back to 1949 could be misleading; modern sailplanes, with their flat gliding angles, do not easily get themselves undershot, because their pilots would never dare to get so low that the glide path would not get them into the field. They would only be liable to get into trouble if the landing was made against a high wind, or in lee of a hill, or if they stalled on the approach.

Among the six categories into which Wg. Cdr. Paul classified the accidents and "incidents" reported to him, those occurring "on the approach," as distinct from the actual landing, were by far the most expensive, accounting for £3,590 out of a total accident bill of £7,151 during 1957; the reason, he surmised, was that one approaches a good deal faster than one lands. Four of these were due to making the final turn so low as to hit the ground with a wing-tip, and together they cost £1,080; yet there were only five other cases of the same kind in the previous eight years.

Rather surprisingly, nearly all of these mishandled approaches were committed by pilots with more than five hours' experience who had not yet qualified for their Silver "C." The standard reaction to this sort of revelation is, of course, "we must give everybody more dual training." But Wally Kahn sensibly pointed out, and John Everitt of the London Club agreed with him, that the remedy is not to increase the standard of instruction, but to detail one instructor each week-end to look after the Silver "C" aspirants, who are apt to be neglected because the regular instructors have so many other people to attend to. Pilots in this category, Wg. Cdr. Paul revealed, were responsible for £4,092 of the total accident bill for the year.

As to "away" landings in unfamiliar fields, there were 13 cases of damage in about 260 cross-countries, giving a proportion of 1 in 20, whereas 90 faulty landings on home sites represented an accident rate of only 1 in 1,442. Finally, total launches divided into total accident costs give an average of 1s. 5½d. per launch, which is 2½d. above the average for the past five years, possibly because the weather was unusually favourable for cross-countries. There was also a modest contribution by a cow, who ate £20 worth of rudder.—A. E. SLATER.

SLEEK SOARER.—The American Schweizer 1-26 all-metal sailplane which can be bought in kit form and constructed in less than 600 hours.

CORRESPONDENCE

From Air Marshal Sir Robert Saundby, K.C.B., K.B.E., M.C., D.F.C., A.F.C.

Terpsichorean Terminology

"PASEUL'S" letter in your issue of March 14 under the above heading reminds me of instances during the last war of the selection of unsuitable code-names for operations. This was due to the system whereby a list of code-names was maintained by the Air Ministry, to avoid duplication, and the next one on the list automatically allotted when application was made.

I remember on several occasions having a battle with the Air Ministry over the allocation to some forthcoming operation of Bomber Command of a name which suggested failure, or invited cynical or ribald comment, or was otherwise inappropriate. Some of the words on the list were extraordinary, and I would never have been surprised if we had been allotted "Bounce," "Stymie" or "Coldfeet," or some such appellation for a difficult and dangerous operation.

Burghclere, near Newbury. R. SAUNDBY.

'Mbarrassing

I BELIEVE Nairobi's new airport which you spell Embakasi should be 'Mbakasi. When first it was being planned I was told it was one of those Swahili names like 'Mwanza, 'Mbeya and many more.

When a cloud of British bureaucrats descended, like a swarm of locusts, on that pleasant peninsula in Victoria Nyanza at 'Ntebbe (Swahili for "throne") they promptly bureaucratized it as "Entebbe" when they chose it for the administrative capital of Uganda. Bureaucrats are notoriously bad spellers. In Malta they spell that lovely city founded by the Grand Master Jean de la Valette Parisot as "Valletta," though those who know its origin spell it "Valetta."

Entebbe is probably past salvation and has passed into the language as such, but let's save 'Mbakasi from being brutally bureaucratized before it is too late.

Bureaucrats are allergic to apostrophes and insist on spelling Earl's Court as Earls Court. Professor Higgins might amplify his opening song in "My Fair Lady," "Why don't the English teach their children how to spell"—as well as "how to speak."

Earl's Court, London, S.W.5. GEOFFREY DORMAN.

Ultra-lights of Yesteryear

YOUR correspondent, J. H. Blake (THE AEROPLANE, March 7), appears to brand me anti-ultra-light because I dislike several "French Freaks." If Mr. Blake would care to peruse back issues of the old U.L.A.A. bulletin he will find mention of a proposed group for ultra-light enthusiasts. The particular enterprise was centred around a Chilton monoplane (a single-seat type); lack of support from supposedly keen pilots led to cessation of work. It would seem that a certain proportion of the club pilot fraternity find a single-seat a hard taskmaster.

The Popular Flying Association is doing a splendid job in so far as encouragement to fly is concerned. Yet a single-seat type has been chosen in spite of previous frustration with the Fairey Junior and Chilton revival projects. I happen to be a solo supporter (the less seats the better), a Chilton would keep me content for many years. The sorry part is that I belong to a minority, unless Mr. Blake would care to contribute some supporters *and* cash!

At present I prefer to spend my pittance flying a British Chipmunk for five hours instead of eight hours of being blown around the sky like a piece of paper.

Keresley, Warwicks. LEWIS G. COOPER.

Age and Experience

IT is important that "Excalibur" (THE AEROPLANE, March 14) should realize that the Corporations recruit pilots, initially as Second Officers, not as Captains. The reason for this is the vast difference that exists between operational Service flying and commercial airline operations—a difference not widely appreciated by Service pilots.

"Experience on the bridge" in commercial flying is there in the shape of the Captain who either gained his experience by growing up with the airline and airways or by many years stint in the right-hand seat. Admittedly the co-pilot next to him may be relatively young and inexperienced but he is nevertheless able to discharge his duties efficiently and safely, whilst at the same time "learning to be a Captain." The decisions and responsibility are the Captain's—bags of hours are not a necessary qualification for an efficient Second Officer.

The youthfulness of the co-pilot also makes him easier to mould to the ways of commercial flying. It is sometimes difficult to teach an old pilot new tricks. A young one is also a better proposition for the airlines as once he has gained his experience he has a longer effective "flying life"!

"Excalibur," joining one of the Corporations at his age and with his experience, could not expect a command before reaching 40 and would then have only 8-10 years of "flying life" left.

It is not that he is too old to be a Captain but that he is too old to be a Second Officer.

Kingston, Surrey. "CORPORATION CO-PILOT."

Groundabout

New Note. I wonder if Wg. Cdr. A. E. Sims has thought of modernizing the R.A.F.'s martial music, of which he is Director, in line with the new character of our young and spirited Service? The old parade-ground oom-pah belongs to the propeller age—let's take a leaf from the U.S.A.F. and on suitable occasions play what I can only call marching dance music. Good for publicity and recruiting—lots of our bright young lads like swing music. Perhaps Wg. Cdr. Sims, with June's Royal Tournament in mind, is already working quietly (if that is the word) on a musical display which will be as modern as the other part of the R.A.F.'s show there, the guided missile interception.

*

Aero Digest. Would you associate freshly-killed chickens with an aero-engine maker's technical requirements? Well, Pratt & Whitney recently bought a batch (or flock?) of them for testing the ingestion capability of the J-57 jet engine. The engine passed with flying colours—and feathers.

*

Cooking on Infra-Red. There seems to be a vague connection between the above example of fowl play and a U.S. aviation magazine's report on a missile which they call the "Firesteak."

*

To the Young in Art. "There are many dogmatic pilots in the World but none of them are infallible in their opinions, not even the youngest of them."—Air Cdre. Allen Wheeler, in a *Shell Aviation News* article on test piloting.

*

Le Potage d'Erby. In a restaurant in the Hatfield district, a D.H. man asked the manager if he was subsidized by Rolls-Royce. Asked to explain, he pointed to the menu—"See there, *Creme d'Artegan*—isn't that French for 'It's that flaming Dart again'?"

*

Wreciprocal. Mike Byrne, Blackburn's publicity manager, sometimes pinches from this column an item for their staff journal, *The Courier*, so let's borrow one of his, picked up when the Beverley was on winterization trials in Canada. Just a notice displayed in a research building there: "If it works, it's obsolete."

by Gordon

NOTES AND EVENTS

TEMPERATURE CHAMBER. — Canadian Applied Research, Ltd., has installed a high/low temperature chamber in the environmental test laboratory at Toronto. With this chamber it is possible to obtain temperatures ranging from −100° F. to +300° F. Having a capacity of 72 cu. ft., the chamber allows the testing of a large section of a wing leading edge.

I.E.A. EXHIBITION.—At the Instruments, Electronics and Automation Exhibition to be held at Olympia there will be lectures and discussions, papers being read between April 17 and 24. The subjects will include "Progress in the I.G.Y.," "Thermo-Nuclear Developments—Sceptre 3," "Instruments in Forensic Science" and "Computers—Numerical Automation."

FLEXFLYTE AIR DUCTING.—Described in THE AEROPLANE of March 14, "Flexflyte" tubing for aircraft ducting layouts is manufactured by Flexible Ducting, Ltd., of Maryhill, Glasgow, for whom Avica Equipment, Ltd., of Hemel Hempstead, Herts, are the sole representatives to the aircraft industry in this country.

AIRCRAFT TRACTOR.—The latest addition to the range of David Brown aircraft-towing tractors is a development of the Turbo Taskmaster Diesel, which is used by the R.A.F., NATO and Commonwealth Air Forces, and many of the World's aircraft manufacturers and airlines. Designed to handle aircraft weighing up to 150,000 lb., under average international airport conditions, the new tractor has twin rear wheels, a 40-b.h.p. Diesel engine, and power-assisted steering. It has six forward and two reverse gears and weighs 9,000 lb., compared with 7,400 lb. for the standard tractor.

ESSAY AWARDS.—The Gravity Research Foundation of New Boston, U.S.A., is offering again this year five awards worth between $100 and $1,000 for short essays for the purpose of stimulating thought and encouraging work on harnessing gravity. The awards will be made for the best 1,500-word essay on the possibilities of discovering (a) some partial insulator, reflector or absorber of gravity or (b) some alloy, or other substance, the atoms of which can be agitated or rearranged by gravity to throw off heat, or (c) some other reasonable method of harnessing, controlling or neutralizing gravity. All entries must be submitted to the Foundation at New Boston, New Hampshire, U.S.A., by April 15.

DART MAINTENANCE.—Morfax, Ltd., of Mitcham, have developed and manufactured this strip/assembly stand for the overhaul of Rolls-Royce Dart R.Da.3, 6 and 7 turboprop engines.

EXPORTERS TO NOTE.—The Port of New York Authority is opening a London trade-development office at 130 Fenchurch Street, E.C.3. It will advise industrialists and shippers on the services which the Authority provides.

B.P.C. FILMS.—The British Productivity Council has issued a new catalogue of its films. The films can be bought from the Council at 21 Tothill Street, London, S.W.1, or hired from the Central Film Library, Government Building, Bromyard Avenue, Acton, London, W.3.

Aviation Calendar

April 1.—R.Ae.S. Luton Branch lecture, "Arctic and Tropical Trials," by R. K. Cushing, O.B.E., A.F.R.Ae.S., in the Napier senior staff canteen, **Luton Airport**, at 18.15 hrs.

April 1.—R.Ae.S. Boscombe Down Branch lecture, "Aircraft Accident Investigation," by E. L. Ripley, O.B.E., B.Sc., D.I.C., A.F.R.Ae.S., in the lecture hall, A. and A.E.E., **Boscombe Down**, Hants, at 17.45 hrs.

April 2.—R.Ae.S. Weybridge Branch lecture, "The Future of Nuclear Propulsion," by Rear Admiral Sir Edward Rebbeck, K.B.E., C.B.; J. C. L. Puxley and Capt. H. Farquhar-Atkins, at the Apprentice Training School, Vickers-Armstrongs (Aircraft), Ltd., **Weybridge**, Surrey, at 18.00 hrs.

April 5.—British Interplanetary Society lecture, "Problems of Handling Large Missiles," by F. R. F. Taylor, B.A., A.M.I.Mech.E., A.M.I.Prod.E., in the Tudor Room, Caxton Hall, **London**, S.W.1, at 18.00 hrs.

April 10.—R.Ae.S. Main Lecture, "Guided Weapons," by R. Cockburn, C.B., O.B.E., Ph.D., F.R.Ae.S., at the Inst. of Mech. Engineers, Birdcage Walk, **London**, S.W.1, at 18.00 hrs.

April 11.—Helic. Assn. of G.B. lecture, "Powered Lift Systems," by C. H. Zimmerman, M.S., F.I.A.S. (NACA, U.S.A.), in the R.Ae.S. library, 4 Hamilton Place, **London**, W.1, at 18.00 hrs.

April 11.—North London Aero Club ball, at the Cranbourne Rooms, **Hatfield**, Herts, from 20.00 hrs.

April 15.—R.Ae.S. Section Lecture, "The Problems of Vertical Take-off," by Dr. C. T. Hewson, in the library, 4 Hamilton Place, **London**, W.1, at 19.00 hrs.

April 15.—Brit. Inst. of Radio Engineers lecture, "Factors in the Design of Airborne Doppler Navigation Equipment," by E. G. Walker, at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, **London**, W.C.1, at 18.30 hrs.

April 16.—R.Ae.S. Preston Branch A.G.M. and film show, at the R.A.F. Association, **Preston**, at 19.30 hrs.

April 16.—R.Ae.S. London Airport Branch lecture, "Titanium," by H. W. Shaw, Ph.D., B.Sc., A.M.I.Mech.E., A.M.I.E.E. (I.C.I.), at **London Airport**, at 18.00 hrs.

GENERATOR TESTING. — The Armature Manufacturing Co. of Oldham has produced an infinitely variable-speed aircraft generator test bench. This unit has a motor operating on 200-250 V., 3-phase, or 380-440 V., 3-phase 50 cycles supply with a speed range of 120 to 12,000 r.p.m., and can be supplied with or without test panels.

TEST PLANT.—B.E.A. has placed a further order with Heenan and Froude, Ltd., of Worcester, for a complete dynamometer plant to be installed at London Airport. The new plant will be used initially for the post-overhaul testing of Rolls-Royce Dart engines but has a capacity of 6,000 b.h.p.—enough to accommodate the Rolls-Royce Tyne.

TRADE MARK.—The range of steel strips and flattened wires produced and marketed by Firth Cleveland Steel Strip, Ltd., is to bear the trade mark "Fircleve."

AUTOMATION GROUP.—Twenty-one engineering bodies have formed the British Group for the Engineering Applications of Automation. They include the Institutions of Mechanical, Civil, Electrical, Chemical, Production, Gas, Mining, Municipal, Structural Engineers, Engineering Inspection and of the Rubber Industry; the Institutes of Fuel, Marine Engineers, Materials Handling and Metals and Welding; the Incorporated Plant Engineers, the Iron and Steel and the Plastics Institutes, the R.Ae.S., and the Society of Instrument Technology.

Company Notices

New Patents

APPLICATIONS ACCEPTED

794,660.—De Havilland Engine Co., Ltd.—"Heat-exchangers."—July 29, 1955 (Aug. 30, 1954).

794,505.—Hobson, Ltd., H. M., and Westbury, R.—"Aircraft."—Nov. 11, 1955 (Dec. 15, 1954).

794,434.—Fairey Aviation Co., Ltd.—"Aircraft."—April 5, 1956 (April 6, 1955). (Addition to 723,895.)

794,795.—Westinghouse Electric International Co.—"Helicopter rotors."—Aug. 7, 1956 (Aug. 12, 1955).

794,407.—Borgs Fabriks Aktiebolag.—"Arresting nets for aeroplanes."—Oct. 25, 1956.

794,758.—Dowty Equipment, Ltd.—"Retractable undercarriages for aircraft."—Oct. 19, 1956 (Oct. 19, 1955).

794,453.—Armstrong Siddeley Motors, Ltd.—"Thrust-reversal devices for jet engines."—Nov. 19, 1956 (Dec. 22, 1955).

794,768.—Cailette, G.—"Jet propelling unit."—Jan. 19, 1956 (Jan. 25, 1955).

Applications open to public inspection on May 7, 1958; opposition period expires on Aug. 7, 1958.

NEW COMPANY

Firth Cleveland Finance, Ltd. (600,091).—Private co. Reg. March 6. Cap. £1,000,000 in 500,000 cumulative redeemable Preference and 500,000 Ordinary shs. of £1 each. Objects: To carry on the business of bankers, capitalists, financiers, concessionnaires, monetary agents and merchants, etc. Subscribers (each with one Ordinary sh.): Pamela A. Plowman and Michael R. Cowper, both solicitors, of 5 Upper Belgrave Street, London, S.W.1. First directors to be appointed by subscribers. Solrs.: Godden Holme and Co., 5 Upper Belgrave Street, London, S.W.1.

Personal Notices

BIRTHS

Bullen.—On March 11, in Washington, D.C., to Christine, wife of Sqn. Ldr. R. Bullen, R.A.F.,—a son.

Cattle.—On March 13, in Germany, to Valerie, wife of Sqn. Ldr. F. H. P. Cattle, R.A.F.—a son.

Deadman.—On March 11, at Lincoln, to Anne (*née* Parkes), wife of Flt. Lt. Deadman—a son.

Heron-Weeber.—On March 14, to Felicity, wife of Flt. Lt. D. Heron-Weeber, R.A.F. Geilenkirchen, B.F.P.O. 40—a daughter.

Lyne.—On March 12, at Gainsborough, to Pamela, wife of Flt. Lt. A. Lyne—a son.

Williams.—On March 12, at R.A.F. Henlow, Beds, to Primrose (*née* Henderson-Gray), wife of Flt. Lt. G. E. Williams—a son.

MARRIAGE

Rosser—Ellse.—On March 15, at Guiseley, Yorkshire, Flt. Lt. W. J. Rosser to D. A. Ellse.